The Builder.

VOL. XXIX.—No. 1494.

The Public Works of India.

IT seems to be pretty generally felt, if not acknowledged, that the material welfare of India depends very much on the Public Works Department. We have no doubt at all ourselves that the dependence is extreme and vital, and we grieve, therefore, over the constant evidences that present themselves of the unsatisfactory state of that Department, of the differences that exist between its two component parts, the military and the civil, and the costly failures that have resulted from the want of proper direction. Some of the latter have not escaped official reprehension. Thus the fall of the building at the Gun Carriage Factory at Allahabad led to an investigation by a committee appointed for the purpose. The mortar was found to be particularly bad, and some officers were removed. An Order in Council which resulted says:—

"In conclusion, his Excellency the Governor-General in Council desires to record that he has reviewed with great sorrow this deplorable history of negligence, incapacity, and corruption—negligence in the conduct of every superior officer who was connected with the supervision of these buildings from the beginning—incapacity to a greater or less extent of almost every subordinate concerned in the work of construction—corruption on the part of those who supplied the worthless materials—and it is impossible to avoid the suspicion that some of the inferior subordinates must also have been aware of the organized system in the adulteration of the lime which was practised throughout."

The publication of this order caused considerable sensation in India, but punishment will not give experience. An influential correspondent wrote to us at the time,—"This accident and the inquiry that followed prove irresistibly how mistaken the Government, whether here or with you, are in employing military engineers to execute civil works, and thus confide to them operations which neither their education nor practical experience enables them properly to carry out. It is a miserable extravagant economy; but perhaps it may ensure a more servile obedience instead of the honest independence of those who know what they are about, and will not allow themselves to be improperly interfered with by incompetent masters." This opinion, as to military engineers in general, is shared by large numbers of persons, but many dissent. Thus the committee who recently inquired as to the employment of officers of the corps of Royal Engineers reported,—

"That the services of officers of Royal Engineers may be turned to greater account than at present, by employing them on civil duties. The military efficiency of such officers is promoted by their employment, in time of peace, on productive or necessary civil work, of a character similar to that required of a military engineer.

The manner in which the officers of Royal Engineers have acquitted themselves in the employments for which they have been selected, in almost every branch of the Government service, has justified the anticipation of fitness which their character and previous training suggest, and proves their practical aptitude for the discharge of various civil duties.

It being essential, for military reasons, to have at home, in India, and at certain military stations abroad, a large number of Engineer officers available, and ready to conduct military engineering operations, a proportion of these officers can, in times of peace, be withdrawn from their ordinary duties for civil employment. A further proportion who are, for military reasons, necessarily distributed at the several military stations, could, concurrently with their ordinary duties, undertake certain local civil duties of a permanent or temporary character."

To this particular question we may one day return; it is not precisely our business at this moment. Our object is with India, and to mention some publications in connexion with Indian engineering and public works which have accumulated before us;—the papers set for students at the Roorkee College; "Professional Papers on Indian Engineering," emanating from the same college; a new edition of "The Roorkee Treatise on Civil Engineering in India;"* "Public Works and the Public Service in India," by Major Evans Bell and Col. Tyrrell;† "The Public Works Department of India: Why so Costly?" ‡ and some others, to say nothing of at least half a dozen letters containing the reiterated complaints of the civil staff.

The "Professional Papers" were initiated and have been edited until recently by Lieut.-Col. Medley. In the quarterly part for November, 1870, the last with which he was connected, illustrations are given of St. Andrew's Church, Kurrachee, erected at large cost, from the designs of Mr. Newnham, C.E., resident engineer of the Sind railway. It is partly Geometric, partly Norman in style, with an iron railroad roof, and is a terribly ugly affair. In fact, the churches that we have put up in India, in our imitative styles, are mostly beneath contempt. In his preface, Col. Medley alludes to some of the special questions of Indian engineering awaiting solution. He scarcely attaches the importance to irrigation that we should do. The introduction of proper means for irrigation would enormously increase the resources of the country. Still, we agree with him, that to make such improvements of value, railways and good roads of other kind must be proceeded with to facilitate the transport of the increased produce. The great difficulty about roads appears to be the enormous cost of the metalling in many parts of the country. And in that view we are disposed to go with those who seriously urge the adoption of stone or iron tramways, or of horse railways, or of a combination of the tram and rail for a cattle-power line, such as has been found successful in America. These have never been properly tried yet, and it is high time that they should be.

The Barrack subject is still in an unsettled state; and the whole question of Architecture for Anglo-Indian dwellings is as open as ever to the clever young architect to solve. "Look at Delhi, for example," says Colonel Medley, where the Delhi Institute in the Classical style faces a Gothic clock-tower, and both under the shadow of such a building as the Jumma Musjid! Similar incongruities abound everywhere; and while we cover the country with hideous bungalows and unsightly public buildings, we have actually set up more than one School of Art to teach the natives, from whom, I fear, we have yet very much to learn."

The "Professional Papers" for July, 1871, is edited by Captain Lang, who reprints our account of the Revenue Board Buildings, in Madras, and gives, as a frontispiece, a photograph of the engraving with which we accompanied it. The part contains a suggestive account of the failure, in four successive years, of the Weir, known as the Lower Coleroon Anicut, in Tanjore.

The "Treatise on Civil Engineering" contains a large amount of information, and will doubtless be found very useful. We can scarcely, however, avoid recognising in it a want, to a certain extent, of practical knowledge and that decisiveness which practical knowledge gives. We desire still to bear testimony to its value.

Lieut.-Colonel Tyrrell, in his essay on "Public Works," is very outspoken, and brings together a number of painful and astounding facts:—

"Under no other form of Government," says he, "could such an utter waste of money go on as we have every year to deplore in India. One of the most densely-populated countries, in some parts, in the world, and one which, from its peculiar formation and climate, requires works of extraordinary magnitude to meet its wants, is delivered over to a party of amateur engineers and financiers really distinguished and dexterous only as précis-writers, to play their pranks in. Do I exaggerate? Look at the Godavery! After that energetic and enthusiastic Engineer, Sir Arthur Cotton, had built the Great Anicut, vast sums were absolutely thrown to the dogs—to the fishes I should say—in breaking down and blasting the rocky barriers, which were found out afterwards to be natural aids of such paramount necessity that, if they had not existed, we should have had to invent them in the form of dams, in order to complete the navigation. Yet it was surely not very difficult to discover that to remove the barriers was to allow water to run uselessly to the sea which it was urgently necessary to keep back, to supply the great wants both of the navigation and of irrigation in the hot weather. There were splendid examples of similar navigation—canals round barriers—in America, which doubtless would have been within the sphere of knowledge of men properly trained as Civil Engineers. But it was not until the loss to India of much money and many valuable years, that the blunder was rectified,—or rather that the blundering plan was abandoned, and a different plan on contrary and correct principles adopted."

What more lamentable monument of amateur engineering can there be than the Ganges Canal? This immense undertaking was designed in defiance of the first principles of hydraulics, a subject in which we might expect such good theoretical men as our military engineers to be "well up." Here we have a great work constructed in apparent ignorance alike of the A B C of theory and of the text-books of engineering experience, of what may be called the historical records of the profession.

The present system has produced a few good engineers; but only a few, and for these the people of India have had, and still have, to pay a vast number of unskilled men at very high rates to superintend and execute work which they do not superintend and do not execute. We make the people of India pay for the good men who gradually learn to do their work as well as it can be done in the Department constituted as it is. We make them pay for the idle men who have been put into the Department as the means of giving them a certain income, and who never learn to do more than get through,—sometimes with great credit,—their monthly routine of clerical duty. The consequence is that India has to pay for works that fall down,—for works that are totally unfit for their intended purpose, and even for work that has never been done at all.

Captain Thomason, who has engineered in India, in the Irrigation Department, since 1854, maintains that the greatest evil of the present organisation is the total neglect of steam and all the modern labour-saving appliances at the disposal of almost every engineer in the world, excepting him of the P. W. D. India. Even the railway engineers in India express their astonishment at this peculiarity of the Department. Their system more closely approximates to that of England; they give large contracts, and thus secure substantial English contractors, to whom, however, they have to allow high rates to cover all risks. To such rates the P. W. D. would undoubtedly object. The Department is thus restricted to the very few respectable contractors of substance in the country; and these are so few that the work eventually falls to the lot of the native petty contractors, who have but one old-fashioned way of working, which, however sure, is undeniably slow and expensive, and the labour of superintending, paying, and checking these petty contractors is found by the executive engineer only a shade of an improvement on the daily labour system: while their power of combination—competition there is little or none—their dilatoriness in starting work, their system of payments in advance, for which the security is

* London: Spon & Co. 1871.
† Trübner & Co. 1871.
‡ H. S. King & Co. 1871.

of the shakiest, their liability to decamp bodily at critical seasons, and so on—all these are an unceasing source of anxiety to the executive, ever working against time.

Some of the shortcomings of the Department are, we have little doubt, in a great measure traceable to the want of workshop training amongst the officers of the Department, and more especially amongst those of the Royal Engineers, who must always exercise so much influence over its destinies. A workshop training is simply an essential to any engineer in the present state of engineering science; and some attention devoted to this important subject at Chatham, where facilities are great, would remove an important objection amongst the many that are urged by some of its civil members against the military element of the Department. It will be a fatal error if mechanical engineering and workshop training are overlooked at Cooper's Hill. The Roorkee workshops should supply the existing deficiency in the Roorkee College.

The employment of skilled British artizans, such as potters, brick-makers, cement-makers, and fitters, seems much needed. Even Calcutta, the city of palaces, sends to England for stoneware pipes! It could hardly be credited that India is rich in clays suitable for all kinds of pottery,—from the most exquisite China cup to a sewage pipe. The kaolin beds of Colgong and Goorgaon would be considered a mine of wealth in Europe; for manual dexterity the potters of Umroba in Rohilcund would be hard to beat; but all these advantages are lost to the country for the want of steam-machinery and a little well-directed energy in developing that potter's art in which Englishmen excel.

The subject is one of enormous importance, and calls for the renewed attention of the Home Government.

ILLUSTRATIONS OF LINCOLNSHIRE CHURCHES.*

WE have already mentioned the publication of the book before us. It consists of a careful summary of the points of architectural interest in the churches in Lincolnshire visited last year by the Architectural Association, under the guidance of Mr. Sharpe, of which visitation we gave, it will be remembered, a pretty full account at the time. The present volume is the result apparently of a careful going over again of the ground traversed on that occasion, and is very copiously illustrated by lithographs of details and portions of the various churches, as well as sections of mouldings, the whole being based on the sketches made at the time of the excursion by members of the party, but subject to careful revision and correction. The book is rendered more complete by small maps of each day's route, showing the line of road traversed and the relative positions of the principal churches.

Among the most interesting and best of the architectural details figured may be mentioned the two beautiful capitals from St. Mary-le-Wigford (plate 25); the early Lancet capitals from Coleby (plate 19), showing a stiff and unmatured form of the characteristic foliage carving of the period; the Norman and Transitional capitals from Whaplode and Harmston; and the very curious and unique specimen of a capital of the Decorated period, from Navenby (plate 16), a feature which seems waiting to receive its further development at the hands of some modern architect. Two of the best and most freely executed, as well as most interesting, plates are those which give details of the sedilia of the little church at Wellingore (plate 15), and the details of the peculiarly interesting late Norman work at Horbling (plate 35). The chancel arch at Whaplode, which we referred to, in an account of the excursion, as an admirable example of what could be done with Norman detail even on a small scale, is very well illustrated in plate 49; and the three little sketches on plate 43, the stair-turret and squinch arch from Heckington, and the head of the stair-turret at Fleet (sketched from the parapet of the tower), are particularly pleasant specimens of that class of detail, so important to the architect, the interest of which consists almost entirely in outline, and the opposition of different planes of masonry.

We scarcely see why Moulton tower and spire should have been selected as the only one to be given at full length; its elegant proportion is unquestionable, and there is a remarkable unity of design about it, but withal a tameness and weakness of general expression: as a study for the architect, we would far rather have seen the grand Early English tower of Gedney (one of the churches visited) given in full, incomplete as the design is: for power, vigour, and breadth of masonic design, without incrustation of ornament, there is nothing like these early towers, as witness also the lower portion of the tower at Welbourne (another church included in the route), of about the same date. We should have liked, too, to have seen the singularly pleasing and artistic spire of Silk Willoughby, of which we know sketches were made on the occasion of the excursion, and which has been done little justice to in Wicks's well-known illustrations of towers and spires.

Perhaps the most useful part of the book we are noticing is the "Summary" at the end, where the principal features of the buildings visited are summed up and compared in groups, taking those of the same date together, and noticing their broad characteristics. By taking the buildings of a district together in this way, many hints, both architectural and archæological, may be struck out, which would be missed without such comparative anatomy, as it may be termed. In alluding to the capitals of the Lancet period, in this portion of the work, two specimens are given from the Continent (Erbach and Longpont) of the same date as the capitals of Lincoln choir, by way of showing how much advanced was the style in England, at that time, beyond the point attained on the Continent. The advantage of the English over the foreign work, however, appears, to our thinking, not so much in the carving of the capitals, on which Mr. Sharpe lays most stress (the French regular, stiff, formal leaf capital has high artistic merits, and is, perhaps, a more strictly architectural treatment than the English), as in the treatment of the junction of the pier and arch mouldings, in which the English example evinces so much more sense of the exact nature of the problem at this critical point. The German leaves heavy square separate *abaci* at the head of each shaft of the pier, abutting on each other at awkward angles; the French builder places a fresh base for his vaulting shafts on the top of the abacus, thus destroying the homogeneous character of the design. In the English example, the relation between pier, abacus, and arch mouldings is far more clearly perceived and defined.

SANITARY AFFAIRS IN DEPTFORD.

THE Parliamentary borough of Greenwich consists of three main divisions,—Woolwich, Greenwich, and Deptford. The ecclesiastical superior of this borough is the Primate of all England; one of its Parliamentary representatives is the Prime Minister of England; the "Local Authority," in certain matters of vital importance, for the Deptford division at least, is an irregular corps of irresponsible flying dustmen. It is quite true that there are District Boards of Works, Parish Vestries, and other bodies, appointed somehow; and rate and tax collectors, who do not, to give them their due, fail to favour the householders with their visits, and to leave copies of the interesting documents it is their business to prepare, in which the amounts are duly set forth that the respective occupiers must contribute towards the maintenance of highways, police, the poor, and other public objects, so that all things may be done decently and in order. All this may be very well, but the people of Deptford do not get a *quid pro quo* for their highway rates. Although they furnish a contingent of 60,183 persons to the population of the great metropolis, the vaunted capital of the world, they might as well live at Constantinople, Cairo, or Jerusalem, or even at Dahomey, as at Deptford, in so far as any responsible public body concerns itself, or takes proper action for the preservation of the public health.

The tocsin has been sounded that cholera morbus is coming, and the inhabitants are counselled to see at once to the cleaning out of their water-butts, tanks, and cisterns. This is good, but inconsistent, so long as the Board of Works, or whosoever has the power, and upon whom devolves the responsibility of performing certain duties to the public, neglect such duties. The Commissioners of Sewers for the City of London have issued a notice to the citizens, that the inhabitants of Deptford who have seen it regard with painful interest. The two first paragraphs are to the effect that "the dustmen in the employ of the Commissioners are to call at every house at least twice in every week, to remove dust, dirt, ashes, cinders, rubbish, refuse, vegetable and animal matter, &c., without fee or reward. The contents of all public dust-bins wherever situate, are to be cleared out and carted away by the dustmen daily, whatever may be the nature of their contents." It may seem incredible, but it is nevertheless true, that the inhabitants of Deptford have no dustman upon whom they can rely to call for and remove the ordinary house refuse, nor any public dust-bins. This large population is absolutely without a dust contractor, and the heads of families,—in most instances the wives,—are left to comply with the terms, and accept the considerations the flying dustmen think fit to impose and concede. In most instances they visit a suburban street in batches, and make the morning hideous by their howlings. They contrive—two howlers to each cart—to take, with splendid lung power, four discordant notes of the gamut all at the same time. The lady head of the house, anxious to have her refuse removed, calls in the first that comes. He demands "a pot o' beer," to which she demurs; whereupon he stamps out, whistling "Tommy Dodd," and bangs the door after him, or leaves it open, with an imprecation. Outside, conversation ensues:—Second Metropolitan Sanitary Officer, *loquitur*: "No go, Bill?" First Sanitary Officer: "Humph! she's good for a tanner if you cut up rough." So the lady has to agree to pay 6d., otherwise a "tanner;" but, to her dismay, she finds that the sanitary officer (No. 2) has simply taken the stuff that may be separated into "breeze" and cinders. These sanitary officers, in a word, come when they like, charge what they like, take from the dust-bin what they like, and leave what they do not like; and from these, in this respect the "Local Authority," there is at present "no appeal." The only alternative to this treatment left to the householder is to find out a place where "rubbish may be shot," to hire a cart, and pay, in addition to his highway and other rates, for having it,—that is, "ashes, rubbish, refuse, vegetable, and animal matter, conveyed to the place, at whatever distance, at which such material may be tipped.

It is true that Dr. Pink, the medical officer of "the Board," delivered at one of its recent meetings a very able and conscientious report on dust removal, water supply, and other sanitary matters; but unhappily it is equally true that the sensible proposal of a member that the inspector of nuisances should have powers to order the removal of dust and refuse was met by the worse than lame and impotent conclusion, that "the matter did not press so much that they should dispense with advertising in the usual way!" Not "press so much!" Can these gentlemen be conscious of the terrible responsibility they incur? An epidemic may be upon them any day, may come when these foolish men are "advertising" and haggling; and be caught, as were the foolish virgins, who had not at the right time provided oil for their lamps. Mr. Glaisher, of the Greenwich Observatory, states that, in the case of former visitations of cholera, he has observed, from his eyry in Greenwich Park, a peculiar blue mist between the Observatory and the river that continued visible as long as the pestilence lasted. Ordinary mists pass away before a wind exercising a force of half a pound to the square foot; but this blue shadow of death remained steadfast and immovable with a wind at nine pounds pressure. It is greatly to be desired that Mr. Glaisher may not have an opportunity of demonstrating the truth of this statement concerning the "blue mist," and its connexion with the terrible avenger of disregarded sanitary laws.

A number of the inhabitants of Deptford have been much exercised of late in connexion with a "nuisance" alleged to be caused by the operations of the Val de Travers Asphalte Company, against whom legal proceedings have been taken successfully. It is curious that in the immediate neighbourhood of this company's works there are sewer-gratings that send out exhalations much more offensive and pestilential than the gaseous vapours from the asphalte, which are really, as are gases from other bituminous substances, anti-putrescent. The sewer-gases compel occupants to close doors and windows,

* An Account of Churches visited during the Lincoln Excursion of the Architectural Association, August 22nd, to August 27th, 1870." By Edmund Sharpe, M.A., F.R.I.B.A. London: Spon & Co.

—sometimes absolutely to leave their premises. There are sewer-gratings in other parts of Deptford equally pernicious and offensive to those referred to. Much official counsel has been given of late to Boards of works and others, and to private occupiers, as to the free and regular use of carbolic acid for the neutralization of sewage gases. We cannot ascertain that an ounce of carbolic acid has been used to destroy the pestilent power of the gases exhaled by the public sewers of Deptford, or, better still, to remove the cause. It may be conceded that the fumes from the asphalte caldrons are not pleasant, and that they are irritating to persons subject to bronchial affections, but they are far from being the most dangerous nuisances borne, unconsciously it may be, by the inhabitants. In the same vicinity,—Deptford Bridge,—over which there is a large traffic, the sweepings of the road may be seen lying along the kerb-stone baking in the sun throughout the entire day, and within a few feet of the doors of the complainants concerning the asphalte vapours. They also bear patiently the exhalations from the Ravensbourne, hard by, which, when the water is let off, exposes a surface of mud and ordure.

If the truth must be all told, there are others than the Board of Works to blame for sanitary defects in Deptford. The builders and the tenants of houses will be both alike chargeable as participants in the pressing invitation to the "blue mist" and its fatal accompaniments should they visit the town. In hundreds of houses, for which rents of from 30*l.* to 100*l.* per annum are paid, there is no provision for the dust and refuse produced from day to day. As regards water supply, it seems almost incredible that the men who can in any way command means to build houses should be men of such crude and coarse ideas as is manifest in their works. In many instances small miserably inadequate uncovered cisterns, are provided in the open air for the daily domestic supply of water. In other instances, the cisterns have slop-work covers loosely put together and gaping at every joint. In many houses rented at 30*l.* per annum, and upwards, the cisterns are placed under the untongued floors of bedrooms! Although the water company now gives a supply on Sundays, which was not done until recently, there is rarely more than enough for domestic wants, and on "washing day" the water supply, in most houses, is almost invariably exhausted long before the day is done. Deptford greatly needs an institution, or the establishment of classes, at which its builders may learn not only the principles of constructive art, but the very rudiments of sanitary law and of domestic civilisation.

DUST AHOY!

AT the present time, when the near approach of the cholera has to some extent stimulated the official mind to exertion, and the warnings of alarmists are less likely to be disregarded on account of the nearness of the calamity they seek to avert, it may be useful to arouse public attention to an evil in our midst, which, although apparently slight in itself, is productive of serious injury to the public health. We allude to the dust-bin system, and the methods employed for the removal of refuse from London dwellings.

Nothing can be worse than the present mode of storing and disposing of "dust" in the metropolis. We are very much inclined to pride ourselves as Englishmen upon our superiority over other nations with regard to cleanliness. A traveller visiting Rome is usually astonished at the dirty appearance of the streets, and congratulates himself that in London things are much better managed in that respect; and yet, in point of fact, the Roman system (although, perhaps, not all that can be desired) is better both in theory and practice than the London plan. In Rome a certain number of places in the public street are marked out in each municipal division or *rione*, called *Immondezajii*, where rubbish of every sort may be thrown, while the depositing of refuse in any other part of the streets is interdicted, and is punishable. There is no box, bin, or receptacle of any kind, but the rubbish is thrown down in a heap, and at stated periods is carted away by the municipality. The advantages of this practice are, that the dirt and refuse are removed from the houses and their appendages, and are placed out in the open air, where they are least liable to do harm; while the public character of the deposit makes its removal a matter of urgency, and any neglect on the part of the servants of the municipality can be readily discovered.

We, on the contrary, instead of putting away our refuse as far from us as possible, construct a receptacle in the rear of our houses and as near to them as possible, or in some dark, unventilated, unapproachable part of the basement, and into this receptacle we fling not only dust and ashes but the refuse of the kitchen, decaying animal matter, oyster and lobster shells, dirty rags, everything in fact that is noisome and offensive, and this we leave to putrify and ferment for months, perhaps exposed to the summer sun, the resort of cats, a nest for rats and mice and still more loathsome creatures. If the household is well conducted, this filthy pit is emptied once a month or once in six weeks, but as it is not uncommonly in an almost inaccessible position, and is moreover not a pleasant subject for inspection, the mistress of the house, if well-to-do, leaves the management of the dust-bin to the servant, who is generally ignorant of the connexion between dirt and disease, and consequently indifferent about the matter. If the mistress is poor, she waits until the bin is filled to overflowing and the lid has been forced off before undergoing the disagreeable process of removal.

In order to still further encourage the practice of storing all manner of filth in our homes, every difficulty is put in the way of its removal by the parish authorities. The removal of domestic refuse is not looked upon in the metropolis as a matter to be dealt with by the vestry directly as it should be, but it is let to a contractor, who pays the vestry for the privilege of removing the dust. The contractor is in no wise interested in clearing out the refuse or leaving the place in which it was contained in a proper condition, but only cares for the dust and ashes, which are a valuable commodity, for which he has paid money. The duty of collecting the dust is delegated to a class of men so brutal and degraded that their very presence in a decent household is an offence. They come round at irregular times, and are difficult to find when they are required. These men generally exact money from the householder under the pretence that they are not paid to remove anything else but ashes, and that if they remove anything else in the shape of refuse it is a matter of favour for which they should be paid. This is a demand very difficult to resist, and if resisted these men revenge themselves by soiling the walls or leaving the floors and yards in such a filthy condition that it is usually thought best to satisfy their exactions. This black-mail presses heavily upon the poor; and it is not to be wondered at, considering this and the class of men employed, as well as the dirt and discomfort they occasion, that the emptying of the dust-bin is generally postponed as long as possible.

These remarks, it is proper to add, apply only to the metropolitan districts, and not to the City proper, where the Commissioners of Sewers have lately taken the duty of cleansing the streets and the removal of dust into their own hands with the most satisfactory results.

Much good might be done by the vestries taking the removal of the dust upon themselves, appointing competent men who should remove the dust and refuse at stated times, and employing inspectors to see that no improper accumulations take place. The only perfect remedy however, is the entire abolition of the dustbin, and the prohibition of the storing or accumulation of dust, filth, or refuse of any kind in or near a dwelling-house. If housekeepers did their duty, and every kind of refuse that could be burned were reduced to ashes, the amount to be removed from each house would be comparatively small. A small covered iron pail or box of uniform pattern should be supplied to each house by the vestry; for this some small charge might be made, and a fine should be inflicted in case of its being lost or injured. This pail, containing the ashes and other refuse that had accumulated during the previous day, should be placed outside the front door of the house every morning. It should not be larger than can be lifted with one hand with ease (in the case of large establishments two or more might be used), and it should be removed every morning by a man employed by the vestry for the purpose with a horse and cart, or even a hand-cart might serve. Different hours might be appointed for different localities, but it ought to be a *sine qud non* that the whole of the previous day's ashes should be removed every morning. A rigorous house-to-house inspection should be made occasionally, and if any refuse were allowed to accumulate the offenders should be punished.

By adopting this plan we should encourage the destruction of vegetable and animal matter by fire, because it would be impossible to put cabbage leaves or lobster-shells in the pails on account of their size, and we should thus do away with a fruitful source of disease and contagion. It is impossible to walk through some districts without noticing that the air is polluted with the smell of dust-bins. Our houses being so frequently built in terraces, with the yards back to back and closed at the ends, the air is but little disturbed, and is a favourable *nidus* for the germs of disease which are thrown off from the stagnant and putrifying contents of the dust-bins placed in the midst in the rear of every house.

We have abolished the dustman's bell—that dreadful bell that some twenty years ago used to fright London from its propriety—let us go a step further, and abolish the dust-bin and the dustman.

IRON AND STEEL.

THE hitherto undiscovered causes of results, apparently so inexplicable and contrary in their effects, to what would otherwise be rules by induction to guide us in our anticipation of producing various kinds of iron and steel, which should possess properties in each case varying in degree in proportion to the quantity of the agent inducted, which should in any proportion give, or appear to give, existence to those properties, must necessarily cause reflection in the minds of many readers, and should, therefore, it may be hoped, be productive of at least a few increments of further discovery and elucidation on the subject.

The consideration of these anomalies presents the following hypotheses, and their resulting conclusions, confirmed, partly at least, by known facts and experiments previously made:—Concerning the introduction of carbon in differing quantities producing apparently opposite effects, we may be led to speculate not only on the result effected *in toto*, but on the result produced on the atoms of which it is composed, considering these to be between minute cells, separated from each other by what are usually called the fibres of the iron or steel.

The cells, however minute they may be, will have a defined form, which probably will alter, at the least a little, by any change that may by any means be produced; the variations in the temperature of the weather must produce an increased or diminished size, according to its degrees (and although, perhaps, somewhat foreign to the nature of the investigations we intend at present to pursue, we may pause an instant to consider whether, when a bar of iron increases in size with heat, it increase in exactly the ratio in weight), and the fibres would necessarily alter in consequence, and the question occurs, how would they alter? Would they become thinner in proportion to the cells they inclose, or would they continue to have the same proportion to these cells? And, again, what do these cells contain?

As iron contains carbon (C) and oxygen (O) increasing in proportion as we take samples, beginning with the white iron and going through the various kinds, as mottled iron, bright iron, and the gradations of foundry iron, it would seem probable that the cells in these latter kinds are occupied by oxygen and carbon, and that one or both of these conduce to, or, perhaps, entirely cause brittleness, and that the cells in the foundry iron are much larger than those in the malleable iron. This theory will appear likely from the consideration that foundry iron is lighter than forge iron, and the equivalent of (C) = 6, (O) = 8, and iron (Fe) = 28·04, and twice the size of (C); then the difference in weight of (C) and (O) combined in the larger cells of the foundry iron, and of the weight of the iron itself, corroborates the hypothesis that those cells exist, though, in common with atomic bodies, they are quite invisible by the most powerful microscopic observation.

But it may be urged that these could not exist in forge iron, else how could a bar be drawn out to (say) $\frac{1}{1000}$ part of its previous size? Would those cells then be 1,000 times as long as they were before? If so, then the fibres would be only $\frac{1}{1000}$ part in area, and how could they hold together, either to each other or lengthwise?

In answer to this, let us consider that perhaps the most important and remarkable property of forge iron is that it is almost, or quite, impossible to fuse it (and most probably because its atoms have a powerful and adhesive affinity for

one another, which is much interrupted by the carbon in the foundry iron), and therefore it is possible that it may be extended 1,000 times, and not part; but if they would not, we may consider the atoms of this malleable and pliable metal to be like marbles filling a box of, say, 3 ft. by 2 ft. by 2 ft., and their surfaces (although only touching at places) to have so powerful an adhesion as only to be moved, but not separated without being torn asunder or cut, and the interstices between them to be nearly filled by additional portions of iron, which should, being pliable (as we must consider our marbles to be), accommodate themselves to the changing form of the respective atoms to which they must be considered to belong; and let us consider that these interstices contain the cells; then it must be evident that if heat and pressure combined would cause these to slip one upon another, the pressure rendering them perhaps a little elongated or acorn-shaped, and the cells likewise, and therefore reduced in cubic space within; and if the box, in performing this, were previously to have had its ends removed, then the continuance of the pressure would reduce the contents to 12 ft. by 1 ft. by 1 ft. = its previous cubic contents. This theory of atoms and cells and adhesive properties in malleable iron must be admitted to be possible, because chemists admit atoms to exist, and that they cannot tell their form; and cubes, squares, triangular, hexagonal, or lozenge-shaped prisms can be the only atoms that could leave no interstices, and these are improbable, because they would not easily, if at all, move one upon another in laminating; therefore, as atoms of any other form must leave cells, then they are at least probable, and also because those atoms are held to be impenetrable; and if there were no cells, then there could be no possibility of their containing carbon. Admitting this, we are bound to consider that when sufficiently heated, the atoms of iron admit the passage between them of the atoms of carbon, and the increase in the size of iron when heated will, perhaps, support this idea; but in this we must not suppose that all the atoms part entirely for the time being; they may act alternately, which might account for the sparkling appearance of iron when at a white heat (the iron in which they would entirely part would, perhaps, be the molten foundry iron). The foregoing hypothesis, if adopted as probable, leads to the supposition that carbon intervenes to some extent between the places of contact and adhesion, besides existing in the cells of iron, and considerably more so in foundry iron than in forge iron; and that hammering the latter, in increasing its specific gravity, forces its atoms closer together, and the carbon more fully into the cells, and more away from between the places of contact and adhesion of the atoms; and in this case the cells cannot previously have been completely occupied with carbon, and we may infer that they will not be fully so after our hammering; and it will be as evident as universally known, that the hammering improves the tenacity and strength of the iron, because it brings its atoms closer together; and not only will they have a greater support from each other, but a greater number of them must present resistance to any given area of resisting surface.

It may also be the case, that the cells being nearly, if not quite, enclosed by the atoms, allow of little or no possibility of escape for the carbon and oxygen; and that when a considerable tensile strain is exerted on the iron, that the cells becoming elongated, and therefore less in volume, exert an elastic force to allow the partial escape of one or other, or both, of the gases confined; and that if the gas or gases were not to find a sufficiently short and ready means of partial escape, that its elastic power (if caused by a sufficient strain) would rend asunder the atoms.

In applying a tensile strain to a bar of iron the difficulty of escape for the gases must be greater the larger the area of the bar, and for the same reason a round or circular form of section would seem to be the least calculated to facilitate such escape, for if the same area were disposed in a slender star-like form the means of escape from the centre of section would be shorter and easier. This hypothesis will explain the fact that a bar of iron which would bear a strain when 1 in. square of 26 tons, would, when drawn out in the form of wire $\frac{1}{32}$ in. in diameter, bear a strain of 40 tons per square inch.

In endeavouring to discover a hypothesis which may help to elucidate the cause of the effect produced by carbon in the manufacture of steel, we shall observe that of the four kinds of iron which could in any wise be considered as fit to be converted into steel, viz., grey iron, bright iron, mottled iron, and white iron, that only the bright iron and mottled iron will be really worth using, because the grey iron will be light and fibrous, and would take too much carbon; whilst the white iron (which is the closest grained or not fibrous), although it is the best and most suitable for forge iron, is nevertheless not open or fibrous enough to admit, even with the expansion caused by the heat of the furnace, the induction of the carbon necessary that it should receive in order that it should become good steel.

The fact, however, that steel is heavier than forge iron can leave us, perhaps, no more probable inference than that its cells are fuller of carbon than those of the forge iron, and that its bulk is not greatly, if at all, altered; and that a piece of it may perhaps contain exactly the same quantity of carbon that a given piece of foundry iron contains, but that the piece of foundry iron will in consequence be greater in bulk and inversely lighter in weight than the piece of steel; this being an essential difference between cast-iron and steel, the superior strength of steel might lead us to consider that the carbon, when admitted in exactly the right proportion, acts upon and causes the atoms to act upon each other with a vastly increased affinity or attraction, and this because the atoms are near or close to each other.

Tempered steel is lighter than soft steel, and it may therefore be considered that some of its carbon must, by caloric effect, have been eliminated; it is also more brittle and harder; and there is, consequently, a striking analogy in this respect between the comparison of soft steel with tempered steel, and that of forge iron with foundry iron.

If the heat causing the elimination were not suddenly absorbed by its immersion in pure or acidulated water, brine, mercury, oil, or tallow (for a second tempering after the first in water), or metallic compositions, or by being swung rapidly to cool in the air, then the consequent continuance of such eliminations would cause the steel to lose so much carbon that it would then not be much harder than forge iron.

The tempered steel, being lighter by the supposed extraction of a portion of its carbon, suggests the possibility that its vacated space will be occupied by some other element; if so, a different tempering medium may induct a different element, or the same one in a greater or less degree: from this it will appear probable that such element will be lighter than the carbon, and possibly the carbon remaining in the steel rapidly absorbs one of the lighter gases from the medium it is immersed in; hydrogen, from its lightness and large proportion in oxide of hydrogen would suggest that to be the gas.

This element, whatever it may be, will, while existing in steel, perhaps be of a more non-conducting nature than the carbon it has displaced; and as the latter is a powerful conductor of electricity, it would, when insulated in the steel, reduce in the atoms of steel the opposite kind of electricity (one positive and the other negative electricity), and the partial presence or absence of this electrical induction will perhaps sufficiently account for the superior strength of soft steel, and the greater brittleness of the tempered steel. This hypothesis would seem to be confirmed by the known fact, that magnetic ores and hydrated oxides are unsuitable to be manufactured into steel; this would be because they would be calculated to repel the induction of the carbon; being already charged with electricity, the one would repel the same kind of electricity in another element, viz., the carbon, and the hydrated oxide would repel either kind in another element if it should contain the same.

In order that steel should resist impact to the best advantage, it should the most nearly approach the hardest of forge iron, and should therefore contain the least possible quantity of carbon.

That steel shells should prove much more tenacious than iron when striking armour-plate could not perhaps at present be investigated with a greater chance of approaching the truth, than by supposing these to be of the most tenacious untempered steel, and which would probably have an excess of resisting power to compression, an approach to the malleability of white iron, but retaining much of that elastic quality which renders steel so invaluable for springs, and so causes the shell to receive the shock somewhat in the manner that powerful springs receive the concussions of a heavy load in a carriage or cart, the heat caused by the concussion against the armour-plate liberating the carbon, and making the steel still less brittle.

The apparent anomaly of a 68-pound shot shattering an armour-plate tempered in oil, would perhaps suggest the contemplation of the effect of concussion on a spherical body.

If a projectile resists as much as it is resisted, then on striking an (to it) impenetrable object at rest, its own momentum only will re-act on itself, and its form, if spherical, will possibly cause the resistance to distribute itself through the shot in divergent directions, somewhat in the same manner that the weight of a large arch (under erection) is distributed by the struts in divers directions, and the fact of there being nothing but air behind the ball, would allow it a mobility and power of reaction which could not belong to it if it were resting on an anvil, and were to receive a blow (of exactly the same number of pounds' weight with the concussion) from a steam-hammer above it; but here the force would also be distributed as before, and possibly to a considerable extent counteract upon itself in a partly similar manner to the counteraction of forces manifested in striking the edge of a plank with an Indian club, when, if one particular part of its length touch (the edge of the plank), and that at about one-third the length from its large end, then there will be no vibration or shock to the hand; but if any other place in its length should touch the plank there will, and the same principle is also exemplified in a sabre, when bars of lead stood on end may, by a very strong and skilful swordsman, have lengths cut off them by causing the right part of the sabre to touch the lead.

The armour-plate becoming shattered by the shot would perhaps be explained by the fact of its being steel at all, and still more so by its being tempered in oil, which is calculated to give the greatest hardness (for this reason oil is used for tempering Mint stamps), and the quality that invariably accompanies that—viz., brittleness, and the backing on which it was mounted would also affect it; and in this the particular property of the plate as to brittleness or tenacity would make all the difference in the effect of the shot in the event of the plate not being solidly mounted—*i.e.*, if its backing does not touch it in all places alike. Suppose it to be hollow, and the shot to strike it in the centre and opposite such hollow, and suppose the metal to be tough and not brittle; then the only way in which the shot could effectively operate on it would be by driving a hole right through it, and its being hollow, would immensely reduce the effect of the concussion; while, on the other hand, if this tough but not brittle plate were fixed on a backing the least convex, then the shot could operate on its centre with its full force. And, on the contrary, if the plate were brittle and not tough, then experiment would probably prove that it would more readily break when slightly hollow at its backing.

And by a similar tendency in brittle steel, and to a lesser extent in soft steel, to fracture with concussion, we may perhaps see the reason why steel vent-pieces were more liable to fracture than those made out of tough iron, and they would probably be less likely to fracture than iron, if instead of being screwed into the gun (as I believe they were), they were to be very accurately turned to fit a corresponding hole to receive them, and (as the gun and the steel vent-piece would probably expand in different degrees under the changes of temperature) it would be well to give a slight draught downwards of (say) one in fifty, so that it could always be made to fit accurately, and thus prevent the vibration the screw vent-pieces would have.

To keep it down in its place the vent-piece should be made with a strong head or flange at top, longer than it is wide, and (to use artillerymen's phraseology) in the front and rear of this head should be a projection on the gun as high as the top of the cap, and these projections should continue over the top of the cap (as far as the latter extends beyond the circular part of the vent-piece), and to have strong screws to keep the cap and its vent-piece down.

To put the vent-piece in, it will only be necessary to turn it round a half circle, that its cap shall clear the screw projection as it goes down.

The vent would be continued through the cap, and which would cause no obstruction to the lanyard in firing the friction tube; but the tangent scale and foresight would in muzzle-loaders have to be placed a little higher.

HENRY AMBROSE.

POMPEII REVISITED AFTER MANY YEARS.

EIGHT-AND-TWENTY years ago I spent two months at Pompeii, drawing and measuring and taking notes of everything. During that period of an autumnal *villeggiatura*, three Germans came there who were professional architects, and they remained as long as myself, their studies being serious pursuits, mine only those of an amateur; yet I managed to obtain a tolerably complete acquaintance with all which up to that time had been done to bring to light the buried city.

Last autumn I had the satisfaction of spending three weeks at Pompeii, partly in reviving my somewhat faded reminiscences of what it was in 1842, and partly in ascertaining what it had become in 1870. The result of these more recent researches, and the contrast of the two periods, furnished many general facts which may not be uninteresting to the readers of the *Builder*.

From all that I had read and heard within this interval of the progress of the excavations at Pompeii, I expected to have found the physiognomy of the city considerably changed by the addition of new features. But here I was somewhat disappointed: Pompeii has not in this respect kept pace with the progress of our modern cities of Europe. For although many private residences and shops have been opened up, and some few public buildings brought to light, as the new baths in the *Via Stabiana*, and the new gate through which we now enter from the railway station by what is called the *Strada Marina*; yet these have only added to Pompeii without altering its character or appearance. What were its grand and leading features in 1842 are its main characteristics still: several *insulæ* have been added to the excavations, and others, in the lines of the original plan, are receiving their development, but essentially the city remains unaltered. The course of the walls of Pompeii forms, as most readers are aware, an irregular semi-oval, with its base on the west side towards the sea, but the wall on this side has not been cleared out. Two main streets running from north to south, and from east to west, the *Via Stabiana* and the *Via Nolana*, bisect each other near the centre of the city, and divide it into four unequal parts.

In all descriptions of Pompeii it is important to bear in mind the course of these streets, the former passing from the gate towards Vesuvius to the gate leading to Stabia, the latter from what was probably the sea-gate to the gate leading to Nola. Regions, islands, and numbers are the only officially recognised distinctions used for indicating the localities of a city somewhat complex in its many byways, and rather puzzling to strangers privileged to go about without a guide. The popular names which have been given to the streets from some peculiar feature in their course, and to remarkable houses from some striking characteristic which they present, or objects which have been found in them, though much more important to visitors, and without which Pompeii would be to them little better than a scientific puzzle, are too trivial to be introduced in the official accounts of the *Scavi di Pompeii*. Yet in the clever and useful journal which is published by the pupils of the *Scuola Archeologica*, established here by the distinguished and persevering director-general of the excavations, the Commendatore Giuseppe Fiorelli, these trivial names are sometimes found. Though only about two-fifths of the area of the buried city have been uncovered, yet the principal temples, those in and near the Forum, and the other public buildings in the neighbourhood of that popular centre of Pompeiian life, will probably never be added to by any subsequent clearings. The first excavation, that of 1748, was made just at the intersection of the two main streets already mentioned, the *Via Stabiana* and the *Via Nolana*, but the houses there found were left in an unfinished state, more profitable digging turned up elsewhere, and this primitive spot, so interesting to the archæologist in the history of Pompeii, is now a very deserted-looking portion of the city. The excavations carried on for a hundred years subsequently were to the west of the *Via Stabiana*, between it and the sea, and included in the south-western quarter of the city, the Forum, the principal temples, the theatres, the soldiers' quarters, and the baths. This is considered to be the oldest portion of Pompeii, and the course of the streets is very irregular. In the north-western quarter, that which was nearest to the supposed fashionable suburb, *Pagus Augustus Felix*, the streets are arranged at right angles to each other, or nearly so, and the *insulæ* are mostly rectangular parallelograms. The well-known house of Pansa, and the house of the Faun, than which no domestic residences of more importance have since been discovered, form two distinct *insulæ* of themselves. The *Via Domitiana*, a continuation of the Appian Way, enters this quarter of Pompeii, at its north-western angle, facing the popular "Street of the Tombs." This was the point at which in former days visitors commenced their perambulations, and it is still recommended to begin here by the editors of old-standing guide books. But the *Strada della Marina*, which brings us up from the railway station, is now the more frequented route, and thus we enter at once on that portion of the city, the Forum, which used to be reserved to the close of the tour, as the locality of most importance.

Reaching the city by the Street of the Tombs, which looks just the same now as it did some nearly thirty years ago, we pass through the *Porta Ercolanese*, and enter the *Strada Corsolare*. The houses and shops in this street have now a rather neglected aspect to what they exhibited formerly; but on the right hand, more than midway along, we observe a new feature in the *Scuola Archeologica*, situated just opposite to the former residence of that well-to-do citizen of Pompeii whose corn-mills and ovens at the back betray his honest calling, and whose stable at the side of these premises is one of the very few to be found in the city. The *scuola* is a college, on a small scale, for the education of archæologists, who are here lodged, boarded, and instructed for a period of three years gratuitously. The establishment is fitted up with comfort and elegance, and there is a well-furnished library, with some 6,000 volumes of the best works on archæology and the sister sciences. Many of our most esteemed English publications here find a fitting home. But the institution, in its collegiate character, is not in a flourishing state. When I visited it last year there was only *one* pupil remaining, the Signor Edoardo Brizio, whose name will frequently be found in the journal of the excavations as the author of some of its most interesting papers. The reason assigned for the deserted state of the *scuola* is the circumstance that the pupils on the completion of their studies do not receive public appointments, and hence the three years thus occupied are too often looked upon as time lost. Add to that, the situation is somewhat solitary and depressing to students, who desire a reasonable gaiety to be combined with their serious studies; and one Neapolitan student who came here was obliged to give it up after the trial of a year. To the visitor who has his comfortable quarters at Castelammare, or comes from the gay and hilarious capital of Naples, to breathe the healthy air of this roofless city, the contrast is agreeable enough; but the epoch of hermits has passed, and the charms of society and the excitements of social life are now recognised as desirable stimulants to the progress of science and its healthy cultivation. The additions to the plan of Pompeii consist chiefly in the excavations of the new baths on the west side of the *Via Stabiana*, where the *Strada degli Olconj*, a continuation of the *Strada dell' Abondanza*, forms an angle with it. They are of considerable extent, and are known as the *Terme Stabiane*; are isolated on three sides, from each of which there is an entrance; and contain a grand *palestra* with porticoes, destined for gymnastic exercises, which the wise ancients were accustomed to erect in or near to their baths, that the youths might thereby acquire force and agility. One side of these baths is in that disreputable and crooked street, the *Vico del Lupanare*; the *insula* extends as far as the narrow *Strada degli Augustali*, and contains two or three new houses of some interest, as the house of *Sirico*, of Venus and Mars, and, between the two, the Elephant Inn,—not the Elephant and Castle,—and which had its entrance from *Lupanare* lane. The house of Venus and Mars occupies the western angle of this *insula*; opposite to it, in the Street of the Augustals, is the house of the Princess Margarite. Excavations were still going on here, and also in the continuation of this street on the other side of the *Strada Stabiana*, where, in fact, was the chief seat of them. The four *insulæ* on the south-west side of this main street, extending from the Temples of Isis and of Jupiter and Juno, to the *Strada Nolana*, and the site of the first excavations of 1748, are now completed; as also is the *insula* opposite to the first of these on the north-east side of the *Strada Stabiana*. In the *insula* between the new baths and the Street of the Temple of Isis are situated two of the most important houses recently brought to light, the house of *Olconio* and the house of *Cornelius Rufus*: the former is at the western angle of the *insula*, the latter is separated from it by the *Casa di Mescinione*. In the *insula* opposite to this, at the southern angle, is the *Casa del Citarista*, and beyond it, with a frontage in Amphitheatre-street, a large house, attached to which was a stable where the bones of two horses were found, and the wheels of a biga, a very important find considering how rare these things are at Pompeii. The *Isola* opposite to the house of the *Citarista* is known as the *Isola di M. Epidio Sabino*. Another house of much interest in the *Strada Stabiana*, and near where the present excavations are being carried on, is the *Casa di Marco Lucretio*, one of the very few with which the name of the proprietor can be associated with certainty. Houses at Pompeii often receive their names from some remarkable fresco painting on the walls, or other decoration which serves to distinguish them, or from some peculiar architectural feature, and even from what may have been found within, as in the case of the House of the Marbles, so called from the variety of beautiful marble slabs which were there discovered. Two other houses which can be assigned with certainty to particular citizens are those of *Sirico* and *Cornelius Rufus*,—the former from the still existing traces of the name in red characters on the front, the latter from a marble portrait of the proprietor. The house of ill-fame, *il Lupanare*, opposite to the Elephant Inn, forms an acute angle with the *vico* of the same name and the *vicolo del Balcone pensile*; the latter is so-called from the remains of an overhanging balcony which were here found, and have been carefully preserved and restored. The house in which this was a prominent feature has become one of the most instructive from its having had its original fittings and conveniences reinstated under the judicious orders of the eminent architect Signor Michele Rugiero, the director of the *scavi*. This is not the only house in Pompeii which had a projecting upper story, and the inmates of which could shake hands out of the window with their opposite neighbours. There are indications of overhanging balconies in other situations also, but it is more especially in this house and its offices that we see the admirable arrangements which were made for the supply of water, and the numerous pipes of sheet lead rolled together through which it was conveyed. The river Sano appears to have been the chief permanent source whence water was obtained, and from this the water-towers, which are very numerous, received their supply. In this house the wooden stairs have been restored, also three rooms on the first floor. The Signor Rugiero, whom I had the good fortune frequently to meet in his periodical visits to the excavations under his direction, very kindly pointed out to me the ingenious contrivances of his Pompeiian predecessors, the original architects, to provide the houses of their employers with all the requisites of civilised life, and these often on a very small scale and effected with the most humble means. Visitors to Pompeii, though taking merely a bird's-eye view of the excavations, should observe somewhat in detail the domestic conveniences of this modest dwelling. Formerly little or nothing was done to restore the buildings in Pompeii, or even prevent them from further ruin. Now, however, the system in operation is to restore so far as is needful to render the architectural arrangements more obvious, and to give a scientific character to the details. The restorations going on at Pompeii may be arranged under two classes,—architectural restorations and domestic ones. To the former belong the temples and other public buildings; to the latter the private houses and shops of the absent citizens, for it is really difficult to realise the fact that they fled from their homes nearly two thousand years ago. In the temples and public edifices, though there is often much to admire, yet there is usually also something to avoid. The architects were not here such exact and conscientious followers of their Greek masters as they might have been, and should have been.

One of the most conspicuous restorations of a public building in progress last autumn consisted in replacing the entablature over five columns of the Temple of Venus. The columns are Ionic, the entablature is Doric. On my remarking this circumstance to Professor Rugiero, he admitted the fact, but offered no explanation of it. We

do not know what was the precise state of the public buildings in the Forum and its neighbourhood when the eruption occurred of August 24th, A.D. 79. The earthquake which happened sixteen years previously had thrown down many of the edifices, which at the time of the eruption were being rebuilt, and possibly the placing a Doric entablature over Ionic columns may have been a mere temporary arrangement. We find the temples of the Forum destroyed almost to their very foundations. An eruption of ashes and scoriæ and pumice would not have produced this general ruin, but an earthquake might, and in all probability did, as Tacitus affirms. The first earthquake took place A.D. 63; a second followed in 64, which was almost equally disastrous, and must greatly have shaken the confidence of the citizens in the security of their houses, and probably may have discouraged the erection of their public edifices. But the population returned, and their dwellings were renewed or restored, in some cases in a rough-and-ready way, and with the materials that first came to hand; but the more stately mansions appear to have been rebuilt; hence we may fix the period of their architecture within the limit of comparatively a few years, from A.D. 64 to A.D. 79. The domestic architecture of Pompeii is peculiar, and is indicative of the habits, and manners, and wants of the people; hence the study of it becomes extremely interesting, and all the aids which it can receive from a careful and scrupulous restoration of its leading features is an advantage to the philosophical historian, as well as to the archæologist, architect, and artist. The architects of Pompeii showed great skill in their plans and in the internal arrangements of the houses they erected. Their adaptations are often most ingenious; and the way that noble mansions, and humble dwellings, and shops of various sorts are fitted in together is one of the most curious features in the uncovered city. There is here much for modern architects to observe, as also in the distribution of the water supply and the system of drainage; but it is to the decoration of the houses that the attention of students is chiefly directed.

H. C. BARLOW, M.D.

ECCLESIASTICAL DILAPIDATIONS ACT, 1871.

SIR,—Will you permit, in order to elicit further expression of opinion, a few more words on this subject?

Section 15 provides that the surveyor shall report,—"What works are needed, *specifying the same in detail*," &c. Section 31 has the same phrase; which, evidently and by all consent, implies that the surveyor shall define to himself what he considers necessary, to the extent required for his own careful estimate, and shall state it in his report with precision; but it does not seem so clear that such a specification, as would be supplied by a careful practitioner for works to be executed by contract for a client in the ordinary way of business, is either within the intention of the Act, or desirable on other grounds.

Section 45 would seem to throw some light on this. "The repairs to be executed in the case of a benefice under sequestration, and the repairs to be executed in the case of the refusal or neglect of the incumbent to execute the same (including rebuilding or repairing in case of fire) shall be executed under the direction of the surveyor, who may employ any builders or contractors to execute the same *according to a specification and contract to be prepared by such surveyor*," &c.; the inference being that the report previously made (Sections 15, 31) is always necessarily to be supplemented in these cases by "the specification" here mentioned. In other cases, *e.g.* repairs executed by an incumbent on the first or final report (Section 16), it would appear that he is to be made aware precisely of the requirements of the surveyor, and then left to his own course as to carrying out the works. In the case of objections to the surveyor's report (Sections 16, 32), most incumbents would employ their own surveyors; and where no objections are made, and in the case of new incumbents, it might not be undesirable that they should make a rule of doing so.

That the language of a report may be precise and unmistakable without the features of a working specification, is shown in every-day experience in careful schedules of dilapidations under leases; honestly taken, there need very rarely be any doubt as to whether the requirements of a well-constructed schedule are being complied with. The working specification would, in many matters easily imaginable in the professional mind, introduce questions that otherwise would never be raised at all; and would often prevent, unless objected to at once, such adaptation of the buildings to other needs and views of incumbents as should from time to time be made,—in order to avoid stereotyping the defects of existing buildings. This may seem to be provided against in Sections 50 and 51, but the machinery there arranged would not be set in motion except in the more important cases: and to the argument that "relief of ecclesiastical persons and their representatives,"—where small outlay is in question, will be in practice one of the main uses of the Act,—it may be replied that it could be made a rule that the surveyor should supply a working specification *after the final report*, for some stated fee if called upon for it, (in cases of works under £);—being informed, if need be, as to any desired minor modifications by the incumbent in his letter asking for the same.

The district surveyors of the metropolis may be considered as engaged in work in idea similar to that of the surveyor under this Act,—making sure on behalf of the community that a practical conformity with certain general standards is secured,—with this difference, that the protection may be supposed to be afforded by them mainly to property other than that of the building-owner; whereas, in the case of ecclesiastical property, the whole of the details of the works needed in the buildings themselves require to be specially looked to. It cannot, however, be to the general interest, and certainly not the interest of the architectural profession at large, to throw too much work absolutely into the hands of officials. The fact that an incumbent may (Section 11 offers no solid objection), and that sequestrators *must* (Section 45) employ the surveyor of the diocese in the actual execution of the works, will inevitably put in his way a fair amount of work, that with the ordinary routine, when the fees are properly settled, should make the appointment worth holding by a properly trained architect in general practice. All this no one will be disposed to grudge him, regarding it as not an undue share of the general professional work, some of which he will be able to do more easily than any one else. It does not follow, though, that one would wish it to be generally understood that there will be little or no opportunity for the employment of non-official persons.

The fact that the larger proportion of all outlay on ecclesiastical buildings will probably always be made without the Act being in question, should not be considered as reducing this matter beneath consideration. An incumbent would frequently wish to employ a surveyor known to, or previously employed by, him. In some instances a more effective supervision can be excercised over local tradesmen, especially in minor works, by a local architect. (It seems not unfair thus to put one side of the case of competent local practitioners, who are perhaps rather too hard pressed by the Leviathans from London and other remote places.) In the case of an incumbent desirous of "altering or remodelling the buildings belonging to the benefice, or any of them, or of rebuilding the same or any of them, &c." (Section 50), the employment of one and the same surveyor to act for the incumbent, and for the diocese, would not be the commonly accepted method of conducting business (as between two parties); to which, when it is not objectionable, and is in fair working order, it is best for all reasons to conform. In the planning of such remodelling, &c., an incumbent might fairly wish to employ his own architect. The case of the "other buildings belonging to a benefice," is of course mainly in view, but what has been said will apply still more strongly to "chancels."

In all cases the approval of the working drawings and specifications could be had, when considered desirable, before signing the contract —*after* the receipt of tenders. It is true that the Act does not prescribe any such step; but though not compulsory, it might be provided for, by a fee being stated for such service when performed by the surveyor.

A difficulty in practice seems likely to arise from the estimate of probable cost (Secs. 15, and 31), not corresponding at times with the amount of an actual builder's tender. As the sum stated in the final report is in some cases to be deposited (Secs. 37, 40, &c.), and in others (benefice under sequestration, Sec. 20), that sum only is to be a charge on the profits of the benefice; it is very clear that a competent and wary surveyor must be appointed, who should, when he can, get placed so that he may steer his course as events require. The mere fact that such a sum has been named beforehand, would often, sad to say, afford guidance of a very valuable kind to some of a set of competing tradesmen.

Another difficulty will probably come from the method of payment provided. Section 44 stipulates for certificates from *the* surveyor, countersigned by the bishop, for payments on account as well as finally, before the governors of the Bounty of Queen Anne pay over any money. This will apparently introduce the surveyor of the diocese (in London diocese, 10s. 6d. per certificate is proposed), — though, oddly enough, in Section 57, treating of injury to buildings by fire, it is provided that cost of reinstatement "shall be paid as the works progress, out of the amount so paid to the governors, on certificates of *a* surveyor," &c. The "the" in line 4, Section 44, is probably a slip (or the "a" in Section 57); it is not easy to see any reason for the difference.

These difficulties would often be more seeming than real, and only give the surveyor of the diocese a little advantage in the race for employment in a few instances. The conclusion would thus be that "the reports" should specify the works required in sufficient detail to preclude the probability of misunderstanding, but not necessarily further; and that the framers of the Act, being in some doubt as to the universal employment of the diocesan surveyor, shaped the matter judiciously, so that by the terms of the Act he will only *of necessity* be called upon to perform certain fixed items of duty.

On the principle that every architect may now consider himself a possible diocesan surveyor, it may seem unwise to throw out suggestions likely to tell against his pecuniary interest,—when looking to that of the public and the profession. You and your readers will, however, probably pardon this, now the Act is under discussion. As to the fees and charges and the desirability of making them and the rest of the routine uniform throughout all dioceses; this may be done perhaps more effectively when, after a year's actual working of the Act, some experience has been gained. For the diocese of London it is expressly stated:—"The above fees and charges are to be of force for one year from the date of the surveyor's appointment, in order that they may then be revised and altered, if necessary;" and by Section 10 of the Act the fullest powers are reserved for alterations from time to time. A short conference this time next year would arrange this and other matters for several years to come; and in the meantime no inconvenience to speak of is likely to result to any one except the surveyors, who will be willing to arrive at the second year pretty generally,—if the *ad valorem* and other scales in other dioceses are framed as considerately for the clergy as some portions of the scale of fees for London.

S. F. CLARKSON.

SIR,—After reading the articles on this subject in your numbers of the 9th and 16th inst., I think no official explanation necessary to remove the ambiguity surrounding the question as to a surveyor's duties, as defined under the 10th section of the Act, but that it rests with those seeking appointments under the Act to submit for approval a scale of charges sufficient to meet all the requirements likely to arise.

My experience, acquired in the execution of numerous works under a similar Act of the Legislature, perfectly warrants the conviction entertained by the surveyor of the Winchester Diocese and other members of the profession. A surveyor, under the provisions of this Act, will hold a position similar to an inspector under the Acts of the Inclosure Commissioners, with the same class of duties.

Taking the 10th section in its literal interpretation, it requires some stretch of argument to make the words "specify in detail" imply the requisition of a purely architectural specification to be prepared by the diocesan surveyor for the use and guidance of a builder or contractor; or that his estimate of the cost of any work consequent upon his inspection shall be other than *approximate;* the last view being supported by the insertion of the word *"probable"* in the sentence referring thereto. The simple construction upon the first words conveys no more than the necessity to enumerate, recite, or point out, in the body of his report, in the form of a

summary or inventory, each particular object coming under his observation which a condensed report could not convey, and he will have to state the condition of each component part as regards preservation, ruin, waste, or defect, and the requirements needed in each case to restore or put in tenantable repair any premises submitted to his inspection; under which operations it will be his consequent duty to give a general or professional opinion of the total outlay that will be involved in such works,—but this only provisionally.

Probably, in many cases, specifications and estimates may be submitted by incumbents or sequestrators to the diocesan surveyor for supervision; and presuming these to meet the requirements consequent upon his inspection, he will embody them in his report accordingly. But as the examination and testing of such documents will entail considerable time and application beyond the inspection and report, a reasonable remuneration for such service must be fixed by a specified fee.

On the other hand, when the surveyor finds it necessary to prepare special plans, specifications, and estimates in thorough detail, for the guidance of builders or contractors, there can be little doubt of his being entitled to the customary professional fees, as between proprietor and contractor, or an equivalent, quite irrespective of the officially established fees for inspections, reports, and certificates, as provided under the 10th section of the Act.

That this is a plain-sense view of the matter I think your readers will readily admit; but, as I have before hinted, those who meditate becoming candidates must endeavour to secure a rate of compensation adequate to the responsibility to be undertaken. SEXTANT.

SCRAPS ON THE STAIRS.

THERE are numerous practical questions connected with the principles of design and construction which deserve more consideration at the hands of the rising school of architects than they really receive. Ventilation, for example, has on the whole been much neglected; and so have the theory and practice of fireproof construction. Still more frequently neglected, although certainly not less important a subject is the building of stairs. If we consider for a moment how many questions are involved in the plan of a good stair; how many constructive problems are concerned in its execution; and furthermore, that no subdivision of a building can be of greater importance, if we except the foundation itself,—we shall easily see that the subject demands attention. Yet some how or other it seems to be taken for granted that we know all about it; and hence very little progress has latterly been made. More particularly we shall find this to be the case if we turn our attention to the designing of what are commonly called common stairs, which parts of a building are, in many cases, nothing more nor less than common nuisances!

It might not be difficult to write a highly picturesque paper—not uninstructive to the modern architect—of the origin and primitive design of the staircase, of its ingenious early construction, and gradual artistic development. A savage of our day, according to Sir John Lubbock, has no stair,* although our own ancestors clearly had such a thing in their hill forts. Passing over its early history, it was during the Elizabethan Period of our own history that the staircase assumed an important place in our domestic architecture generally. From the splendid proportions of the staircase at Haddon Hall, to that unique gem of Sir Christopher Wren's, which is hidden in the Chapter-house at Westminster, a progressive catalogue might still be compiled from ancient mansions, illustrating the relative principles of design and use as well as construction and decoration. Nor would such a compilation be without its use and influence at this moment, as we have hinted. Handrails and balustrades, unlike the slender and rickety contrivances which are now so much in vogue, were always of bold and handsome proportions, presenting a picturesque outline and just proportions, together with a superadded feeling of stability and strength. Verulam House, in order to show what could be done with lightness and airiness of artistic construction, had a beautiful staircase of timber, the posts at intervals being decorated with carved figures of priests and mendicant friars. Many other such instances could be quoted, but we can only mention two, which may be very familiar to architectural students.

Connecting two of the principal chambers of Wrexham Castle was one small and beautiful staircase, with octagon screen embattled at the top, containing double flights of stairs winding round each other, after the design of Palladio; and the east stairs at Wimbledon House which led from the marble parlour to the great gallery and the dining-room were richly adorned with wainscot of oak, with gilded fillets and with stars of gold.

Enough of this, however, at present. Our object is not so much to deal with ancient as with modern staircases; and even in this category we shall pay more regard to the staircase which is called "common" than to that which adorns the stately mansion or public building. To this end we proceed to write out one or two of the most ordinary definitions, which, although trite to most of our readers, we will nevertheless presume so far on their indulgence as to recite.

1. In the first place, "*a staircase* is an enclosure formed by walls or partitions, or both, for the reception of an ascent of *stairs*, with such landings as may be necessary." If we add to this definition (which together with those which follow, is condensed from Gwilt), the circumstance that a staircase may either be *internal* or *external*, it will then be complete.

2. *A dog-legged staircase* is one which has no opening or well-hole, and in which the rail and balusters of the progressive and returning flights fall in the same vertical planes.

3. *A bracket staircase* is one which has an opening or well-hole, with strings and newels, and is supported by landings and carvings.

4. *A geometrical staircase* is one of which the opening is down its centre (technically termed an open newel), and in which the end of each step is supported by being fixed in the wall.

5. *A common staircase.*

The whole subject, strictly speaking, belongs to the constructive science of *stereotomy*, that is, of cutting solids to certain conditions of structure and equilibrium; and no builder can enter largely into the design or construction of staircases (or anything else) without a competent knowledge of the important principles of this science. In the dog-legged staircase, for example, where the steps are fixed at their inferior termination to a solid newel or upright pillar; and on their superior termination (or broadest end, in plain language) to the circumjacent wall, how often do we see the whole stability and equilibrium of the building destroyed by a sinking of one or other of the foundations, or by an unequal distribution of the superincumbent weight? Again, how often do we find in an apparently well-planned geometrical staircase, that the auxiliary support (which is obtained obliquely upwards, from the fact of every step resting on that which is immediately below it; the lowest, of course, resting on the floor) is defective; consequently that the whole stair leans inwards towards the railing. "Staircases," says Palladio, "will be perfect if they are spacious, light, and easy to ascend." *

How many of the domestic staircases in London which are every day constructed could bear the most slender scrutiny under these rules? How many are spacious? How many are light? How many are easy to ascend? These questions we may briefly try to answer.

As to the question of space, that is really in a crowded city a matter of such unfortunate predetermination that the designer has very little room to choose. And yet we cannot help pointing out, as an extremely unfavourable comparison, the fact that some of the older houses in Bloomsbury have wider staircases than many houses in certain quarters of Belgrave-square. It is surely bad architectural practice to punish the width of a staircase for the sake of its rooms. The staircase, it should always be borne in mind, bears the same relation to the carcass of the house that the aorta does to the human heart. It is the chief artery of circulation; or, if we must run our surgical metaphors to the death, it ought with still greater propriety be compared to the alimentary canal through which the food is first of all introduced, next digested, then assimilated, and finally expelled! Above all, the staircase is the only medium of conducting fresh air from the basement to the uppermost story: the solitary tube, so to speak, which connects the building with the earth and the atmosphere. Assuming for a moment the necessity of that connexion, how frequently is the latter wholly disregarded.

As to the property of easy ascension, a very few words will suffice. Without going into specification of the dimensions of risers and treads, it must be clear to the commonest capacity that there is a *via media* (not easy to hit sometimes) which is absolutely necessary to the plan and elevation. Some stairs are too difficult to ascend; but there are others which are far too easy! (*Facilis descensus inferni*, &c., says the poet). This latter case, which, of course, occurs the most seldom, may be easily discovered in such public buildings as the British Museum, the London University, and many other of our Classical public buildings, where the dimensions of the steps are made part of the architectural effect. It seems, however, to be almost a law of nature that the sectional angle of steps on any given wall should not much exceed or fall short of 45 degrees. And it is a very remarkable fact, although it partakes of a paradox, that a stair which is very easy of *ascent* is not so easy of *descent*.

We cannot stay to discuss the many questions involved in the material of steps. Pine, oak, mahogany, Portland stone, sandstone, limestone, granite, even *malachite* (in the Princess Matilda's *salon* in the Champs Elysées), have been applied to this purpose, and, distinguishing them into their respective uses as regards domestic or public stairs, which, we should like to ask, is actually the best material? How many lives have been lost by steps wearing irregularly. Did ever any person who has had the good fortune to go to sea inquire into the danger of those brass-tipped, leaden-covered, and totally dangerous curtailed steps by which he was condemned to ascend and descend from the deck to the cabin? And can any readers supply a reason why this exceptional form of step should be now introduced into some of our best modern hotels. Of all places in the world, a ship and a hotel are precisely those which should not have dangerous steps! Yet there they are!

It is hardly necessary to impress on the public mind that an excess rather than a deficiency of light is required in a staircase. Yet how often do we find that the stair is the dirtiest and dingiest part of a house; and, with regard to ventilation, we very much suspect that this most important subject is in many cases treated as a mere matter of accident; and there are still many more cases, we are afraid, where there is no provision made for ventilation at all? One word more. In this climate it is surely necessary; yet how seldom is it possible to make even the most slender provision for heating staircases, and how many dangerous colds, catarrhs, and bronchial disorders are the direct consequence. Putting all these desultory limits together, we trust we have done sufficient to show that there is need for improvement in our present methods of constructing staircases.

We would now say a few words concerning common stairs, in the construction of which our Scottish neighbours and friends must be allowed to have the advantage in practice. A very curious question was raised during the progress of the last census in Scotland, which, although no one seems to have pointed out its importance, is nevertheless calculated to create much misunderstanding, and even error, in our vital statistics. The question was this, *What is a common stair?* which again resolved itself into the definition of, What is a house? The census commissioners held that a house must only be considered such when it is divided by party-walls,—just as it is held, under the Metropolitan Building Act; and accordingly much of the enumerators' work had to be gone over again in Scotland, with the result, we can have no doubt, of totally altering our conception of the nature and number of what are styled inhabited houses. For, as our readers must know quite well, by far the majority of houses in Scotland consist of lofty tenements containing *flats* or floors entering to each from the different landings of the same common stair. Sometimes each flat consists of one house; more frequently of two; in numerous cases of three; and when in the process of years such tenements fall into decay or disrepute, as they have done in the High-street of Glasgow or the Gallowgate of Edinburgh, it is quite impossible to affirm with truth how many single rooms they are not split into, and how many families may not be found living in these single rooms.

* Some of the lower animals have, however—*e.g.* the beaver. *Vide* Huxley.

* See his rules, quoted in "Gwilt," under the division of "Architectural Practice," par. 2,804.

If we wish to study the effect of common staircases in the walled and fortified cities of the fifteenth and sixteenth centuries, we cannot do better than go to Edinburgh. Our readers who have not had the opportunity of studying the common stairs of that celebrated city *in situ*, as the geologists say, cannot do better than read some of the graphic descriptions of Sir Walter Scott,* which were always drawn from the life. The late Robert Chambers also, in his well-known "Traditions of Edinburgh," pointed out how those ancient tenements gradually grew in height and (owing to a system of overhanging floors) in breadth until they finally excluded all light from the narrow alleys which separated them; the consequence being the creation of deadly plague-spots and hot-beds of contagion and disease.

The original common stairs of the Scottish domestic architecture were ordinarily external, commonly situated at one angle of the building. Afterwards, the exigencies of street space demanded that they should be constructed internally, usually, however, at the front or back wall, with window-openings corresponding to those of the different floors. Such was the nature of the staircases in the first great modern extensions of Edinburgh and Glasgow, which, to do them justice, are better lighted and ventilated than the more modern common stairs, such as we may see in Newington or Sanchiehall streets, where the staircase-wall is built in the very centre of the building, imperfectly lighted from the roof, and with positively no provision for ventilation whatever. But, the whole agree in this particular, that they are totally destitute of any provision for escape from fire. A common staircase should be open at both ends, just as much as an alley, or a close, or a wynd. Had the poor people in the Canongate of Edinburgh been able to scramble to the next roof, even through a hatchway or a storm window, they need not have precipitated themselves from the windows into the courtyard, as they were compelled to do by raging masses of flame and conflagration beneath and behind them. Surely that is a simple proposition; and among our municipal and police Bills, why should it not find some place? We recall this incident as a caution to local authorities and others concerned, who supposed those stairs to be fireproof, because they were built of stone. That fallacy has exploded. Recent events in Paris have taught us that we ought to look at our main principles of construction with the idea that they might one day or another be put to the same test. And if we suppose a petroleum conflagration kindled at the basement story, the first question which ought to be considered is how to get the superincumbent people out of the disaster. On this head we may also remark that the condition of the steps are often deplorable; in fact, it is pitiful to observe the manner in which those high narrow steps are worn down in some of the Edinburgh and Glasgow common stairs; and, unless we are misinformed, many fatal accidents occur thereby every year. Almost the whole of the poorer staircases should be flushed as regularly as a common sewer; and many of even the better order have as much need of a louvred ventilator on their roof as a crowded public building or a brewery. M.

THE NEW TOWN HALL FOR WIRKSWORTH.

THE foundation-stone of the new Town-hall for Wirksworth has been laid. The building will be situated at the corner of the Market-place and Coldwell-street, and extend through to the churchyard, to which it will have a small frontage. The site is irregular in form, and it has been a matter of difficulty to adapt it to meet the various requirements.

On the ground-floor the Market-hall, 30 ft. by 28 ft., is placed at the corner, and the remainder of the frontage to the streets is occupied by shops and entrance doorways. The principal entrance is from Coldwell-street, and leads into a hall, 22 ft. by 12 ft.; opening from which is the billiard-room, 26 ft. by 21 ft.; reading-room, 27 ft. 6 in. by 21 ft.; supper-room, 28 ft. by 25 ft.; cloak-room, lavatory, &c. The principal staircase leading from this hall to the first floor is 12 ft. wide, and constructed of Yorkshire stone. A second entrance is provided opening from the Market-place, and access to the upper floor is gained by a staircase, 8 ft. 6 in. in width. On the one-pair floor is an Assembly-room, 60 ft. by 30 ft. and 25 ft. high, and the remainder of the space on this floor is occupied by four rooms to be used as occasion may require. The building is Gothic in style, and from the nature of the site varied in outline; it will be faced with stone from the Beacon Hill quarry, near Wirksworth. The Assembly-room forms the most prominent feature in the elevation, and at the junction of this building with the shop adjoining, a tower, 10 ft. 6 in. square, rises to the height of 71 ft.

Mr. Edwin Thompson, of Derby, has contracted to erect the building for 4,000*l*. Messrs. Picton, Chambers, & Bradley, of Liverpool, are the architects; and Mr. Alfred Roome is the clerk of the works.

* See in particular his account of Colonel Mannering's visit to Advocate Pleydell, in "Guy Mannering," chap. xxiv.; and elsewhere.

STATE OF THE SEWERS, ST. GEORGE'S, HANOVER-SQUARE.

THE authorities of St. George's, Hanover-square, are, after the manner of parish authorities in some other places, apparently indignant at certain statements made in the *Builder* relative to the foul condition of the sewers in Belgravia, Eaton-square, St. James's Park, and Westminster, and as to their containing a mass of stagnant sewage, in ruinous flat-bottomed sewers, swarming with rats. Mr. H. T. Tomkins, surveyor to the parish of St. George, Hanover-square, is ordered to write to the *Builder* a contradiction of the statement. This he does, but in a very qualified sort of way. "The sewers in Belgravia," he states, "are not flat-bottomed, but are either egg-shaped or have invert bottoms." An egg-shaped sewer certainly cannot be said to have "a flat bottom," but a sewer with vertical sides and segmental invert is practically flat,—it is flat in its retarding effects on the flow of the sewage, it is flat in its accumulation of deposit, and in any description of the system must be classed in a list of sewers under the general heading of "*Flat-bottomed*." It is probable that some recently-constructed sewers are egg-shaped; but, as these sewers have their inverts at the general level of the branch or side-sewers and tributaries, they (the egg-shaped) afford very little relief to the flat sewers over the areas on the sides. In some respects they act injuriously, by removing the whole of the scouring power along such lines, and back-watering, and so rendering stagnant the tributaries, from their juncture upwards. Mr. H. T. Tomkins, we suppose, is fully aware of this, and therefore qualifies it by writing as follows:—"In so low and level a district it is, of course, impossible to get, in every case, that amount of fall which is desirable for proper and efficient drainage; and, while some of the sewers have, in consequence, a *large amount of deposit*, a large proportion have a good and uniform fall, and are almost wholly free from deposit." If Dr. Love, the chairman, and Mr. Walker will read this statement of their surveyor's carefully, they must, we think, acknowledge that they had better have ordered him at once to cleanse out that "large amount of deposit," in anticipation of an outbreak of cholera, and have let contradictions of the *Builder* alone. But will Mr. H. T. Tomkins fully explain to his committee how, in so "low and level a district," he gets "a good and uniform fall in certain parts, almost free from deposit," but "large amounts of deposit over the generally flat area?" There is an evident contradiction in this statement.

The next qualification comes with a round-about assertion of, "Moreover, the general condition of the brickwork is very far from being ruinous [Query, How far?], and my own experience proves *that these* sewers are *generally* free from rats." Now, what has this word "generally" got to do with the question? The sewers harbour rats; and, as they are animals averse to publicity, they probably have not turned out or *swarmed* for the surveyor's special inspection. Mr. H. T. Tomkins may, or he may not, have made himself acquainted with the condition of the first-constructed sewers of Belgravia,—those with flat inverts, vertical side-walls, and semicircular arches,—miles of which sewers are officially reported to have distorted and ruinous side-walls. These sewers were examined officially, and there should be an available record of their condition (with sectional diagrams) somewhere, unless it has been lost in the break-up, change, and removal of the Old Sewers Commission. We do not accept the vague assertion that "these sewers are *generally* free from rats" as any proof worth listening to. There are rats, and the men (sewer scavengers) who occasionally work in these sewers report that the Belgravian sewers swarm with them. We believe the sewer-men in preference to accepting the qualified statement of the surveyor. But there is another source of danger in the sewers of St. George's, Hanover-square, — namely, dumb-sewer shafts; that is, contrivances liable to be injurious to human health, and dangerous to human life. These shafts rise from the crown of the sewer to within 1 ft. or 2 ft. of the street-surface, and in place of an open grate ventilator, are covered with a flag or plate of iron, and are paved or macadamised over. Early in this month (September, 1871), a workman, using a naked light beneath one of these dumb-shafts, caused an explosion of sewer-gas (said to have been coal-gas), which injured him so seriously as to necessitate his removal to the hospital. The committee of St. George's, Hanover-square, must know of this. *They do know of it;* and Dr. Love, the chairman, had, therefore, better at once, we think, request Mr. H. T. Tomkins to report to the committee the number of these covered shafts on the sewers within their district, which are liable to store explosive gases beneath the public road-ways, and to order their immediate and permanent ventilation, as such gases, accumulating until undue pressure fill the sewers, permeate through the drains to the houses in connexion, causing fevers occasionally, but always depressing sickness.

Sewers which contain putrid deposit, which harbour rats, which are partially in ruins, and which have dumb-shafts filled with explosive and deleterious gases, do not admit of valid defence. The duty of the committee of St. George's, Hanover-square, and of their surveyor, is not to defend their foul sewers, but at once to cleanse, repair, improve, and ventilate them to the uttermost.

SIR,—The sewers in Belgravia are not egg-shaped, nor have they, strictly speaking, invert bottoms. They are of the old Westminster shape, with flat segmental bottoms, upright sides, and semicircular crowns, the sizes being 5 ft. 6 in. by 3 ft. and 5 ft. by 2 ft. 6 in. in the clear. They are, therefore, sewers of deposit. In many the deposit partly, in some it entirely, while in others it more than fills what is called the inverts; and the liquid in consequence meanders to the outlets in rills between banks and mounds of deposited filth. Formerly this was removed periodically, by lifting to the surface and carting away, but of late years it is *supposed* to be removed by flushing.

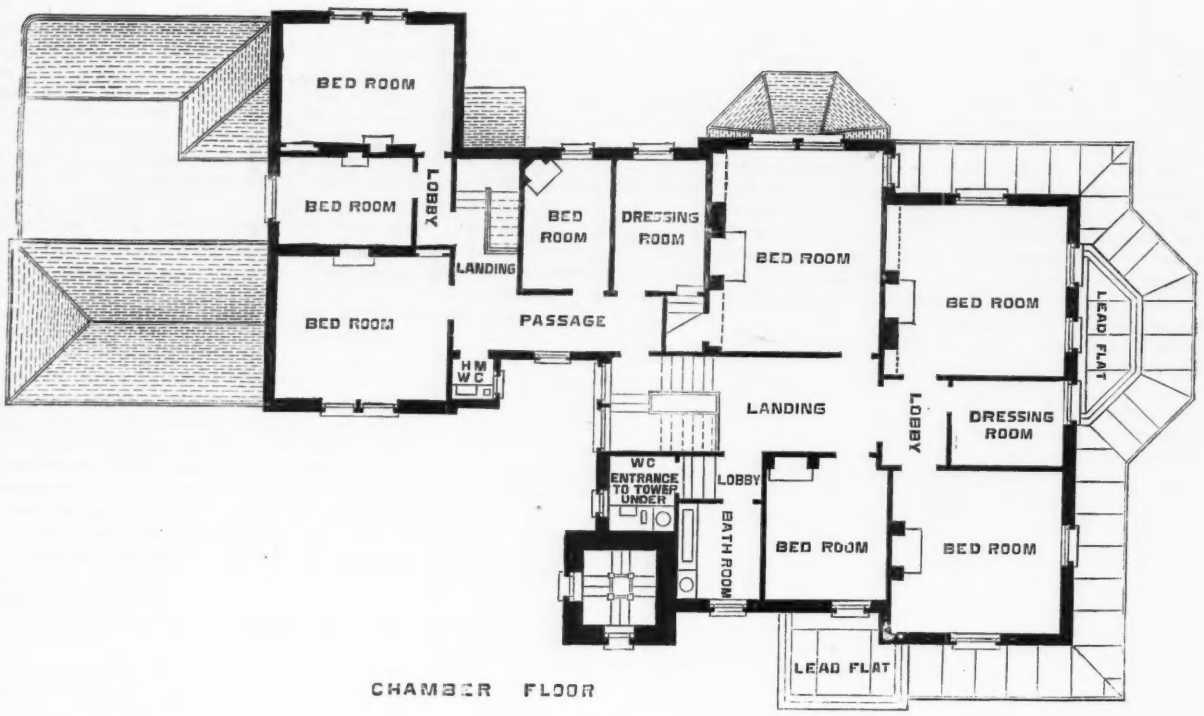
The capacity of these Westminster sewers is such, that if the outlet ends were to be bricked up so as to turn them into reservoirs, those with house-drains on one side only, as in Belgrave-square, would hold all the sewage produced for three weeks, and those with house-drains on both sides, as in Eaton-place, would hold all the sewage produced for about ten days. The whole of the sewage produced during any one day would fill little more than one-half the capacity of the curved inverts in the one case, and little more than their whole capacity in the other. The quantity of sewage, however, does not run, as you know, into the sewers in regular proportion through the day.

The *maximum* discharge from a sewer with house drains on both sides of it, as from that in Eaton-place, for instance, is no more than twenty-two gallons and a half per minute, or three pints per second. From this it should be obvious to any one at all acquainted with the subject that even the maximum flow in the sewers (spread as it is over nearly flat bottoms 3 ft. and 2 ft. 6 in. wide) is utterly powerless to remove heavy substances, such as fœcal matter, wet paper and rags matted with hair, condensed balls of fat from scullery washings, &c.; and hence such matters must necessarily deposit and accumulate. This has been and is the condition, not only of the sewers in Belgravia, but of those all through the metropolis. And such will continue to be their condition until a general plan is prepared for improving the levels and narrowing the inverts so as to concentrate the flow, whereby it may be made sufficiently powerful to sweep all ordinary sewage matters before it and prevent deposit.

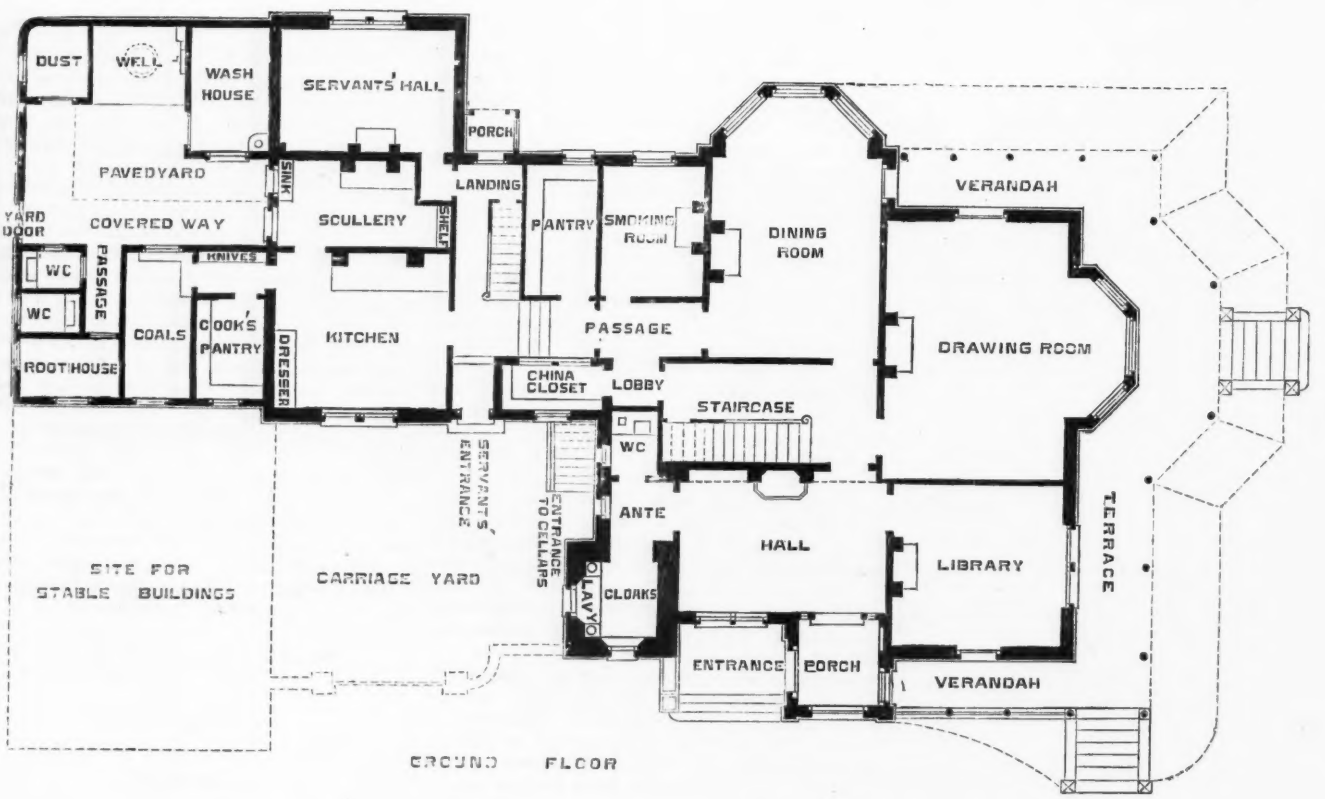
From the practical experiments I made in the sewers while I was chief surveyor to the Westminster and Metropolitan Commissions, I satisfied myself that all sewers of deposit could be made self-cleansing. The first really egg-shaped sewers were put down in Pimlico by Thomas Cubitt in 1846, soon after the Westminster Commission adopted them. These, you will remember, were of my form. The streets and sewers in Belgravia were made long before this took place, so that you will be correct in saying that there are no egg-shaped sewers in Belgravia, which lies south of Pimlico.

If the sewers of deposit in Belgravia, in Westminster, and in other parts of the metropolis, were to be altered generally in accordance with the section I send you, I would stake my existence that they would be self-cleansing. The money expended in flushing such sewers during ten or twelve years would pay for the work. And then consider the great benefit that would accrue to public health by the sewers being everywhere free from deposit. J. P.

New Bridge at Leeds.—On Wednesday afternoon the foundation-stone of the new bridge which is to cross the river Aire was laid by the mayor. A public banquet took place in the evening. The cost of the new bridge will be nearly 20,000*l*.



CHAMBER FLOOR



MR. HORTON'S HOUSE, PENMANMAUR.

Plans.

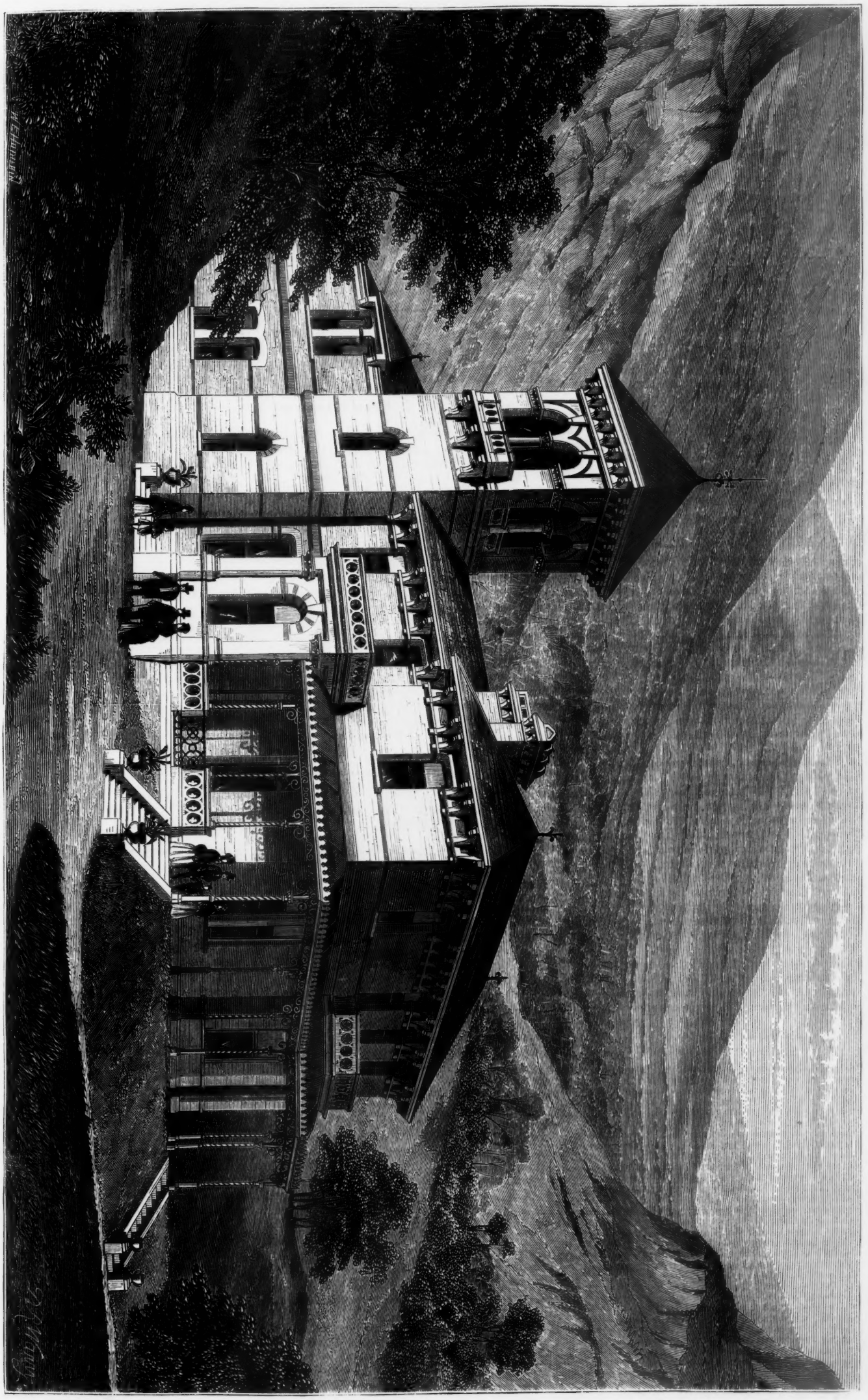
A RESIDENCE IN PENMANMAUR, NORTH WALES.

OUR engravings illustrate a residence which has just now been erected for Mr. Horton, in the very delightful neighbourhood, Penmanmaur, from the designs of Mr. J. Fogerty, architect.

The external walls of the basement, to the level of the plinth, are of native ashlar stone, lined with brick, with fender-walls where required. The remainder of the walls throughout are of hard brick, with white stone dressings to the windows, porch, tower, &c. The roof is covered with slates. The large entrance and staircase halls and the porch are laid with Minton's mosaic tiles. The floors of the dining and morning rooms have a border of parquet, laid by Messrs. Howard, of London. The drawing-room ceiling is handsomely decorated by Messrs. Jackson & Son. Gas-pipes are laid throughout, and pneumatic bells are fixed. The ventilating arrangements have been considered, and flues are built with Boyd's patent plates in the chimney-stacks, to carry off the vitiated air from the rooms. These flues are trapped with valves to prevent down-draught.

The house is heated throughout by hot air, supplied by iron tubes from an apparatus in the basement, and so arranged that the temperature in any room may be regulated. This is of great consequence, and enables the house to be left uninhabited in the winter without danger of the furniture receiving injury from damp. The verandah was supplied and fixed by Messrs. McFarlane, of London.

The builder was Mr. C. N. Foster, of London, and the total cost of the house, including chimney-pieces and grates, was 4,850*l.*, exclusive of the architect's commission.



A RESIDENCE IN PENMANMAUR, NORTH WALES.—MR. J. FOGERTY, ARCHITECT.

THE LATE MR. A. D. GOUGH, ARCHITECT.

ALEXANDER DICK GOUGH was born an the 3rd of November, 1804, and at the age of 19, after having travelled on the Continent, where he evinced a taste for the study of architecture, entered the office of the late Mr. Benjamin Wyatt as a pupil, and was subsequently entrusted by him with the superintendence of the erection of Apsley House, the Duke of York's Column, and other important works. After remaining with Mr. Wyatt as pupil and assistant for several years, he commenced practice in partnership with his fellow pupil, Mr. R. L. Roumieu, in the year 1836. Among the principal works carried out by them may be mentioned the Priory, Roehampton, the seat of the late Lord Justice Knight Bruce; the Islington Literary and Scientific Institution; St. Peter's Church, Islington; St. Matthew's Church and Schools, Camberwell; the reconstruction of St. Stephen's Church, Islington, and the erection of schools and parsonage-house for the same. In the year 1848 the partnership was dissolved.

The following may be named as some of the principal public works carried out by the late Mr. Gough, after that event, viz. — St. Matthew's Church, Islington; St. Paul's Church, Schools, and Parsonage, Chatham; St. Mark's Church and Schools, Tollington Park; St. Jude's Church, Schools, and Parsonage, Mildmay Park; St. Philip's Church and Schools, Arlington-square; St. John's Church and Parsonage, Tunbridge Wells; St. John's Church, Marchington, Woodlands, Staffordshire; Christ Church, Ore, Sussex; St. Mary's Church, Hornsey-rise; St. Barnabas, Mission Church, Kennington; St. John the Evangelist Church, Hull; St. Saviour's Church, Camberwell; St. Anne's Church, Poole's Park; the Soldiers' Institute, Chatham; Industrial Schools, Cardington, Bedfordshire; and the building, enlarging, or restoration of other churches, schools, and parsonages, besides the erection of residential buildings, and the usual routine of his profession.

In the midst of an active career, extending over thirty-five years, Mr. Gough was suddenly seized with an illness occasioned by an internal injury, and after twenty-four hours' intense suffering, borne in the knowledge of approaching death, with the greatest patience and resignation, he passed calmly to his rest on the evening of the 8th inst., leaving a large circle of friends to mourn their loss.

His funeral took place on Wednesday, the 13th of September, when he was laid in the family grave in Highgate Cemetery.

We understand that the practice carried on for many years by the late Mr. Gough will in future be conducted by his sons, Messrs. Charles H. & Hugh R. Gough, of Whitehall, both of whom were for many years associated with him in his professional career.

THE INDUSTRIAL CLASSES ABROAD.

LAST year a series of carefully compiled tables, relative to the condition of the industrial classes in foreign countries, were published in the *Journal of the Society of Arts*. An inquiry of a more general and extended character has since been made in accordance with instructions given by the late Lord Clarendon to her Majesty's diplomatic and consular agents. The result has appeared in what is termed "Further Reports respecting the Condition of the Industrial Classes, and the Purchase-power of Money in Foreign Countries."

The first of the series which claims attention concerns the working-classes in Belgium. The workmen's dwellings are described as being better in the villages than in the towns, mainly on account of the difference in rent. It is in the narrow and unhealthy quarters in towns, where there is but little circulation of air, that entire families live, and this is observable generally in large towns. The workmen's homes in the country are healthy and well kept. The generality wear the blouse, week-days and holidays alike; it is the costume of the masses, as the cap is their usual head covering. Primary schools for young children and adults are not wanting, but scholars are wanting for the schools. The price of labour per day varies in the different employments in the country according to the season, and averages, in summer, for men, 2 francs 25 cents; for women, 1 franc; in winter, respectively, 1 franc 50 cents. and 80 cents. Glass-making is an immense branch of industry, and has its headquarters in the environs of Charleroi.

In Germany, by the incorporation of the smaller German States with the North German Confederation, liberty has been granted for each native to settle and seek his livelihood in any part of Germany, so that there is an increasing change of journeymen in all branches of industry. So recently as 1862, every workman was bound to be a member of a guild, or "innüng," before he could enter on a profession. By the new law this has been abolished, and every one is free to practise his particular trade without let or hindrance. We learn from Mr. Annesley, our consular representative at Hamburg, that by many the moral position of the workman is considered not so high as when the protective system of guilds was in full operation in every trade, and that the freedom which they have obtained has been taken advantage of by them to the injury of their employers; and that those artizans who formerly competed for quality now look upon quantity as the only thing worthy of consideration and effort.

Throughout nearly the whole of Prussia, we are informed by Mr. Petre, artizans, journeymen, and apprentices work regularly in summer from 5 a.m. to 12, and from 1 p.m. to 7, and even later; and in winter, from daybreak, sometimes from 6 a.m. to 8 or 9 in the evening. The extreme length of the hours of daily labour is, indeed, one of the dark features of the condition of the working classes in Prussia, and generally throughout Germany. According to some researches made by Dr. Engle, the cost of food has been ascertained to absorb 62 per cent. of an annual income of between 300 and 400 thalers (45*l.* to 60*l.*), and, when the income is double, 55 per cent. In incomes which fall as low as 33*l.*, this per-centage rises to 67 per cent., and in incomes of 26*l.* to 71 per cent. On the other hand, the outlay for lodgings generally falls in such cases from 12 per cent. to 8·3 per cent. and 9 per cent., and only exceptionally rises, preserving, on the whole, its fixed character.

The Saxon consumes more bread, but less meat, coffee, and sugar than the Englishman; at the same time that, as a married man, he abstains to a large extent from the favourite beverage of both countries, which is beer. The rent of Saxon dwellings is about 2s. 6d. weekly, for a working man with a wife and three children; for two rooms and a kitchen, from 6*l.* 15*s.* to 7*l.* 10*s.* per annum. The rooms in which working men live are usually healthy, and are chiefly in the upper stories.

SPITALFIELDS AND ST. BRIDE'S.

SIR,—With reference to your paragraphs in last week's *Builder*, headed "Spitalfields and St. Bride's," permit me to point out that the property in Spitalfields belonging to St. Bride's parish occupies a site in Fashion-street (formerly "Fosson-street"), nearly 280 ft. long, with a frontage of about 80 ft. to Brick-lane. It adjoins Spitalfields Churchyard, and comprises three houses in Brick-lane, a public-house at the corner of Fashion-street and Brick-lane, twelve houses in Fashion-street (two of them public-houses, and one a common lodging-house), and sixteen houses in Union-court and Union-place in the rear entered by two passages from Fashion-street. Several of the houses in Fashion-street are very old, and certainly ought to be pulled down. So beyond doubt should the hovels called Union-place, and the small cottages, the sheds, and similar erections in Union-court.

Looking at the character of the neighbourhood and its inhabitants, I submit that an opportunity now offers for effecting one of the best improvements made in the vicinity for many years past by clearing away all the old and dilapidated houses and buildings on the property in question, and placing thereon well and economically designed erections for letting in tenements. Large houses and warehouses are not needed, but *tenements are*, and this need is *the want* of the neighbourhood. Not only so, but the site is admirably suited for the purpose, as I look at the churchyard, with its avenue of plane-trees, some of the finest in London, as a permanent source of light and air extremely valuable in connexion with this property. As an evidence of the want referred to, I venture to assert that nearly all the existing houses are let in tenements,—a separate family in almost every room,—and that in houses quite unfitted by structural arrangements for the purpose.

At the same time care must be taken to prevent the erection of nightly common lodging-houses on the property. Spitalfields has enough of them, and to spare.

As a public officer, with over twenty years' thorough acquaintance and official association with Spitalfields, I beg, through you, to urge these views upon the consideration of those connected with the matter. A PUBLIC OFFICER.

BRATTON ST. MAUR, SOMERSET.

A MANSION is now in course of erection here for Mr. Charles Penruddocke, of Compton Park, Wilts. The architect is Mr. James Soppitt, of Shaftesbury; and the builders are Messrs. W. Clarke & Son, of Bruton.

The walls are built of "Forest marble," quarried on the spot, with Doulting stone dressings; the roofs are covered with Whitland Abbey green slates; and the interior joinery throughout is of red pine, varnished. The encaustic tile pavements are by the Poole Architectural Pottery Company; the parquet flooring by Messrs. Howard & Sons, Berners-street; and the cooking and warming apparatus by Mr. T. Richards, of Wincanton. "Claridge's Patent" Asphalte is used for protecting walls from damp adjoining the terrace garden.

The water supply is obtained from an ancient well at a considerable distance below the house, whence it is raised by one of Messrs. Warner & Son's double-action horse-power deep-well force-pumps, to a reservoir built on the highest point of the estate, whence water is laid on through galvanized iron pipes to all parts of the house.

The style adopted as a *point d'appui* by the architect is English Gothic of an early and simple type, modified where necessary to meet the requirements of modern society.

THE DRAINING OF THE TIBER.

SIR,—Observing that you have written an able article on this subject, it occurred to me that I might take the liberty of calling your attention to a curious old Latin volume (which I have in my library), published in the year 1580, containing, in addition to the letter-press, forty-nine plates, showing proposed new mills and bridges, and also a proposal to obviate the inundations of Rome, by diverting the course of the Tiber. As the plan there proposed seems to me not only feasible but in accordance with the views of the best engineers and architects of the present day, and as it is desirable that when they have drained the river, they should avail themselves of the opportunity to alter its course, and otherwise improve it, I think it well to call the attention of the public to the matter. I have made a translation (which accompanies this), and a copy of the original Latin. The engravings are executed by Cæsar Titian, a nephew of the great painter of that name. It would be wise if the King of Italy were to renew the Roman era by doing the work as splendidly as those works which were executed by the Fabii, Paolo Emilio, and others, who in time of peace employed the Roman legions to execute the public works, and spare the public erarium, as well as avoid the soldiers becoming effeminate and unworthy of the name Roman. The military engineers in Italy are perfectly at home in the conduct of such works, and the soldiers could easily be induced to do what is required by a small increase in their daily pay.

F. O. BEGGI, M.D.

Very frequently I reflected in my mind, and I have also asked the opinion of many friends, and yet I have not been able to understand the cause, or discover why the Roman princes,—who never feared the greatest expenses, either for the public good or for their private grandeur, and for the public comforts and ornaments of the city of Rome, although there has been always an abundance of clever architects, nevertheless,—have not been able to repress the impetuous inundations of the Tiber, which ever brought great dangers and excessive damages. There is no doubt to those who have read their history that formerly they effected what they undertook. Is it, then, now impossible to find means to check the impetuosity of the Tiber which so violently assails and desolates the city? Is there no money for such works? Certainly, at this time the Romans have not the riches they possessed when the Roman Empire was swaying everywhere, but assuredly there is enough and quite sufficient for these and other works necessary for the city. Are there no expert architects? Yet in our days many have spoken and written upon this subject, but, nevertheless, I cannot assent to their opinions. Amongst them some think of diverting the Tiber by the deep valley of Hell; others propose to carry off part of the river out of Rome above Monte Celio, which could hardly be done with the riches of Crœsus. I shall not tell here what trouble the ancient as well as the modern architects have taken to attempt with strong dams to repress the force of the river far above the city to divert its course. I am of the opinion of those who think that all this work can be done by carrying the river around the city at a moderate expense. To demonstrate

my assertion, first of all it is to know the causes of the inundations, of which there are two chief ones. The first is that the bed of the river is occupied by many edifices, and besides the public and private bridges which serve for the mills, many of them are massive, and greatly retard the flowing waters, preventing their free course. Here I wonder with what judgment those ancient architects dared to construct those bridges. They did not reflect that they were occupying the third part of the bed of the river with the piles; therefore, they should have at least widened the bed in proportion where they built the piles. But, to say nothing of the others, what shall I say of the bridge which is now called St. Mary, which fell lately by the memorable inundation that happened in the time of Clement VIII? No doubt that in olden time it had frequently fallen, and that it will fall again whenever it is rebuilt in the same manner. It being placed in the confluence of two currents caused by the upper island, it receives the other part of the current obliquely, which is a great over-abundance of water pressing against the piles; according to their extension, it must necessarily fall. The second cause is, that the river, with its three curves, prevents the waters flowing straightly to the sea, and these curves not only retard the waters, but cause the swelling to retrogress. Let any one say what he likes, I think that these evils should be remedied in the following manner. First of all, at the three curves three rectilinear ditches ought to be made. The first is to begin from St. Andrea up to the right flank of Castello St. Angelo; the second, from Ponte Sisto up to Porta Portuense; the third, from about halfway of the road which leads from the city to the sea, as the third curve of the river occurs there. After that it is necessary to widen the bed of the river where the Farnesian Garden is up to the Columbara, and consequently to destroy all those houses which are erected on its banks from the Farnesian Garden up to Ponte Sisto, which occupy a great part of that bridge. Thirdly, to demolish all those stone bridges which are in use for the mills, and substitute for them wooden bridges (suspension bridges will be preferable). There are other things that I might say to the purpose, but I am loath to add more, as I am of opinion that things will remain as they are now. I have said enough to satisfy my own opinion, and administer a subject of discussion to those who delight in such speculative subjects.*

LEEDS SANITARY EXHIBITION.

THE proposed exhibition of sanitary and domestic appliances and contrivances in connexion with the Social Science Congress at Leeds is just now causing some little interest among manufacturers and dealers in all kinds of apparatus and things relating to the advancement of the public health.

The applications for space have been numerous, and as the trustees of the Old Cloth Hall have very kindly placed at the service of the Association their large and commodious hall, there will be no scarcity of room for the proper display of the articles sent. Specimens, models, drawings and plans, samples of food, drinks, and scientific appliances conducive to the health of the community at large, will find a place.

THE NORTHERN CRYSTAL PALACE.

A WELL-WRITTEN pamphlet, by Mr. Francis Roubiliac Conder, C.E., on the "Alexandra Palace and Park,"† draws attention to its importance to at least one-tenth of the population of the whole country, as a means of cheerful recreation and amusement, with the view of urging, from much higher motives than any merely pecuniary one, how desirable it is that the Northern Crystal Palace of the metropolis should be completed and fairly set agoing, for the advantage of the people, not only of the metropolis but of many neighbouring and other country towns.

With right feeling and thoughtful foresight, Mr. Conder discourses on the sad circumstance (to which allusions have for long been occasionally brought to mind in our columns) that the extremes of wealth and poverty in this country are becoming greater and greater, and the isolation of these extremes, with some few distinguished individual exceptions, more and more complete; that a deep-seated and terrible dissatisfaction with regard to these extremes is firmly established in the minds of the multitude of the workers throughout the country; that a revolution such as has never yet taken place upon the face of the earth,—of which even that of the Communists in Paris was but a mild specimen,—is threatened, whereby the very foundations of society,—of social and individual independence,—are placed at stake; and that it behoves all who have the social welfare at heart to do everything in their power to strengthen these foundations, and to paralyse the impracticable theories of dreamers who think to sink the natural selfhood of mankind into the common good by natural means and progress alone; while, in truth, their communistic ideas are just the climax of the selfish principle itself, involving a thievish desire to seize from others what they possess, and to appropriate and divide it all into a few perishing morsels for themselves: a strange and futile attempt to transform the *selfish* principle of nature into the Christian principle of *self-denial*, and not at all like the *community* of the disciples of the true Lord and Master of life.

We are glad to hear that the tontine scheme as to the Alexandra Palace for the people is making hopeful progress.

* Translated from "Machinæ Novæ Fausti Verantii Siceni."

† Spottiswoode & Co., Printers, New-street-square.

BUILDINGS FOR MUSIC.

SIR,—A short time since I noticed various contributions in the *Builder* towards finding fixed laws for the proper construction of buildings devoted to music, lectures, &c. One of your correspondents seemed to think that a series of experiments was desirable in order to discover these laws. With the view of helping in this direction, I beg leave to send you the result of an experiment which I lately made in an empty room.

I tried singing in various parts of it, and always found that on approaching the walls, the difficulty of singing was increased, and the melody diminished. In approaching close to the walls the sounds of the voice would hardly flow out,—they seemed to be forced back; and this I attributed to the extra force of the reflected air-waves, owing to the proximity of the reflecting surface, and came to the conclusion that the proper position of the sound-producer should be in the centre of the room, so that the air-waves might be reflected with a similar velocity, and in similar directions. This would make the flow of sounds even, and one wave would not be driven for want of room across another. It would not, perhaps, be too much to assert that a spherical shape would be the best for an auditorium with the sound-producer in the centre making some allowance for the extra weight of the air in the lower part of the said sphere. But as this would be inconvenient, it could be modified, using a half sphere for the shape of the room, or raising the sound-producer somewhat nearer than is usual to the actual centre of the enclosed space, so that all the air-waves should be reflected, and meet together again in equal times and spaces. This would be treating the air as its nature requires, and the result would be, I think, satisfactory.

G. F. HUTCHINS, Architect.

MONUMENT TO THE LATE DUCHESS OF SUTHERLAND.

A MONUMENT has been placed in Trentham Church, to the memory of the late Duchess of Sutherland. Mr. Noble was the sculptor. The figure rests between Life and Death in its full length, on the tomb as its last bed. The monument is placed at the east end of the south aisle, and the light of a south window falls on the countenance of the figure on the tomb beneath. The floor is laid with encaustic tiles, bearing the arms of the Trentham family and the cipher of the deceased.

The inscription was written by Mr. Gladstone. It runs thus:—

"Henriettæ Ducissæ de Sutherland
Fido marmore descripta effigies
Ejus carissima imago
Nunquam non videbitur inter suos morari
Quippe quæ et multum et a multis amata
Haud scias annon magis ipsa amaverit
Egregia mentis et formæ dotibus
Gnata soror uxor mater parens
absolutissima
Habuit insuper e cordis benevolentia
Quod in amicos large dimanaret
Dulcedinam et deliciarum omnia
Queis frui datum est hominibus
Illi carpere diutius licuit
Illi quod rarius circa se diffundere
Sub extremum vitæ spatium
Etiam in doloribus spectata
Nusquam mediocrem se præbuit
Denique Dei Opt. Max. consilium libenter amplexa
Et usque ad finem sine mollitie tenerrima
Tranquille in Christo obdormivit
Londini xxvii. die Octobris
Anno Redemptoris xvccclxviii."

It has been thus translated:—

"The faithful effigy, in marble, of Harriet, Duchess of Sutherland. Her beloved image will ever seem to linger amongst her own, as of one who, much loved and by many, loved perhaps yet more in return. Eminent in gifts of mind and person, and as daughter, sister, wife, mother, kinswoman, most perfect—she possessed furthermore, in the wealth of her heart, an abundant store for her friends. Whatever of sweetness and delight is given to mortals to enjoy she was permitted long to taste, and had the rarer faculty of spreading it around her. During the latest period of her life, tried also by searching pain, she proved ever equal to herself. At length, embracing freely the purposes of God, and to the last most tender, but not weak, she calmly fell asleep in Christ, in London, on the 27th of October, A.D. 1868."

On the panels on either side of this inscription are the texts:—"I am the resurrection and the life, saith the Lord: he that believeth in me, though he were dead, yet shall he live, and whosoever liveth and believeth in me shall never die." "I heard a voice from heaven, saying unto me, Write: blessed are the dead which die in the Lord, saith the Spirit; yea, that they may rest from their labours." "He will swallow up death in victory, and the Lord God shall wipe away tears from off all faces." "And there shall be no more death, neither sorrow nor crying, neither shall there be any more pain; and sorrow and sighing shall flee away." On the upper mouldings of the tomb occur the words, "When the ear heard her then it blessed her," and "He giveth his beloved sleep."

At the head of the tomb we read,—

"In te misericordia in te Pietade
In te beneficenza in te s'aduna
Quantunque in creatura è di bontade;"

and at the base, "In memoriam matris," the following:—

"This monument to the beloved memory of Harriet, Duchess of Sutherland, wife of George Granville, 2nd Duke of Sutherland, is erected, in the church which they rebuilt, as a loving tribute to her spotless life. A.D. xvccclxxi."

THE SCHOOL REQUIREMENTS OF LIVERPOOL.

THE local statistical sub-committee have submitted a report on the school accommodation and requirements of the borough, supplemental to that already made, and explanative of differences of statistics with those of the census. This report gives the following statistics:—

	Accommodation for	
Existing public elementary schools	56,566	
Schools intending to become elementary ...	5,908	
New public schools in course of erection...	5,049	
		67,523
Non-inspected elementary schools	3,622	
Industrial schools	3,740	
Private schools.....	1,551	
		8,913
		76,436
Balance to be provided for.....		25,585
		102,021

Although accommodation for 76,436 children is already provided for throughout the town, the average attendance is said to be only 40,898.

The report was adopted.

FACTORIES AND WORKSHOPS.

A BLUE-BOOK has been issued, compiled by the inspectors of factories, showing, county by county, the number of factories and manufacturing establishments coming under the supervision of the inspectors of factories by the Factory Acts 1833 to 1867, and also (so far as could be ascertained) the workshops under the Workshops Regulation Act of 1867. The information was chiefly collected in the last two months of the year 1870; and the former part of the return may be considered as nearly as possible accurate, the information having been supplied by nearly every manufacturer in the United Kingdom; but the statistics of workshops are in many places only partial. The returns show, county by county, the nature of the manufacture, the amount of machinery, the moving power, and the number and class of persons employed. The returns for England and Wales give an account of 97,074 works, employing 2,006,978 persons,—viz., 1,364,713 males and 642,265 females; 54,853 boys and 43,878 girls employed are under 13 years of age. Of the whole number of persons employed 573,521 are in Lancashire and 414,709 in Yorkshire. The returns for Scotland show 30,139 works, employing 409,921 persons,—viz., 264,507 males and 145,414 females; 3,566 boys and 3,418 girls are under 13. 144,498 of the whole number are employed in the county of Lanark. The returns for Ireland show 3,129 works, employing 123,890 persons,—viz., 65,009 males and 58,881 females; 786 boys and 1,399 girls are under 13. 49,905 of the persons employed are in Antrim. There are separate returns of the occupations carried on in large towns, in manufacturing establishments in which the hours of work are regulated by an Act of Parliament. The number of persons employed in such establishments in the city of Glasgow is 114,864,—viz., 76,054 males and 38,810 females; in the borough of Manchester, 45,433 males and 27,807 females; and in the

borough of Salford, 13,310 males and 9,997 females; in Leeds, 37,628 males and 14,904 females; in Sheffield 40,306 males and 5,586 females; in Bradford, 24,212 males and 18,700 females; in Dundee, 15,700 males and 21,610 females. The returns fill 275 folio pages. It may be well to explain that the term "workshop," as used in the Workshop Act, does not include every place of work, but only those in which children, young persons, or women are employed in manual labour in the way of trade or for gain in making any article or finishing or otherwise adapting it for sale.

THE SEWAGE QUESTION.

Brentwood.—It seems that a considerable portion of the sewage of Brentwood is conveyed daily to Mr. Preston's farm at Harold Wood by the main outfall sewer, which is said to be now in working order, although, as may be remembered, there was lately a serious sinking in the line of large drain-pipes there. The inverted iron syphon has been proved, it is said, by gauging, to discharge the quantity estimated by Messrs. Russ & Minns, the engineers, who have carried out the work, and the velocity at which the sewage travels through it may be judged by the fact that upwards of 1,000 gallons per minute are discharged by it at the highest point, while at the lower levels the quantity is considerably in excess of this amount. There are altogether about 85 acres of land laid out for cultivation by irrigation; many acres have already been irrigated; and appearances are said to warrant the conclusion that the problem of conveying the sewage of Brentwood and distributing it upon land suitable for its reception is satisfactorily solved. It is anticipated that the entire main drainage works will be completed in less than a month from the present time.

Kingston.— Windsor and Kingston-upon-Thames have received formal notices, as we have already noted, that they must discontinue the discharge of noxious matter into the river. The sewage question there is likely therefore ere long to have the careful consideration of the local authorities of these two places. Mr. Dunscombe, the borough surveyor, at Kingston, is, we understand, preparing a scheme for utilising the sewage of the district over which he has charge. His idea is to group with Kingston some of the outlying villages, the sewage of the whole to flow into a large reservoir, from which the liquid and a certain proportion of rainfall shall be pumped and carried over land laid out for irrigation. The effluent water, which should, of course, be thoroughly purified, would fall into the Thames. The irrigation scheme adopted at Croydon is said to have fully realised the expectations of its promoters, the land over which the liquid is conveyed yielding unusually large crops; and that the system is not injurious to health is believed from the fact that villas within one-eighth of a mile from the Beddington Irrigation Fields are let at from 60*l.* to 70*l.* a year each.

Bradford.—The question how sewage can be best purified and utilised has long engaged the attention of the Bradford Corporation. The adoption of Goux's system of earth closets, it is thought, will tend to diminish the foulness of the sewers, and, if successful in working, form an important aid to the efforts of the Corporation in the direction of purification. After mature consideration and full discussion, a sub-committee of the local Finance and General Purposes Committee has decided that it is desirable to make arrangements with the Peat Engineering and Sewage Filtration Company, subject to satisfactory terms being agreed to on their part, for the purification of the Bradford sewage. The engineer and the manager of the company, which has its headquarters at Liverpool, stated to the committee that they had examined land of the Corporation on which the sewage would have to be defecated, and were satisfied that there would be no difficulty in treating the sewage so as to discharge the effluent waters colourless and odourless. The company proposes to purify 6,000,000 gallons of sewage daily; and, as liberal terms were offered to the Corporation, the company was requested to prepare plans and estimates, with a view to obtaining plans for the necessary works. The plans were to be submitted shortly; and, when approved, the scheme will be put into practical effect as soon as possible.

COMPETITIONS.

The Halifax Infirmary.—A special Board meeting of the governors of the Halifax Infirmary has been held at that Institution, for the purpose of receiving and deciding upon the report of the quarterly board as to the best mode of giving effect to Sir F. Crossley's offer, and as to the plans procured, with a view of utilising the site for the new Infirmary. The chairman, Mr. John Crossley, said they would all be aware that plans had been advertised for, and that the award of the quarterly board had been given, the one selected being that of Mr. Bakewell, of Leeds. Twice, however, that week, a meeting had been called; but upon both occasions they had failed to obtain a quorum, and there seemed no alternative but to adjourn the meeting until more of the members of the quarterly board were at home. The mayor said there were ten gentlemen present, but only three were members of the quarterly board. The meeting was adjourned for a month.

The Dundee Town-House.—The council have received the report of Messrs. Clarke & Bell, architects, Glasgow, regarding the competitive plans of the new Town-house Buildings. The plans,—sixteen in number,—were all sent to Glasgow, with the printed instructions issued by the council as to what accommodation in the new buildings was wanted. The report said:—

"In accordance with instructions contained in your letters of date 14th and 16th of August, we have carefully examined the plans submitted to us, and in our opinion the premiums ought to be awarded as follows, viz.:—

First, to the design signed 'Esperanza.'
Second " " 'Prudentia.'
Third " " 'En Avant.'

In coming to this decision it may not be out of place to say that all the designs are susceptible of improvement; and although upon the whole 'Esperanza' approached nearest to the instructions and the probable wants of the Corporation, we could not recommend his plan to be carried out without alteration."

The report pointed out certain defects in the design.

The letters were then opened by the clerk, when it was found that the plan signed "Esperanza" was prepared by Mr. David Mackenzie, Dundee; "Prudentia," by Mr. Maclaren; and "En Avant," by Mr. George Shaw Aitken, Dundee. They accordingly resolved that the premiums offered of 50*l.*, 30*l.*, and 20*l.* respectively, should be awarded to those gentlemen. It was also agreed to request Mr. Mackenzie to report upon the suggestions of Messrs. Clarke & Bell, and to furnish an estimate of the cost of the buildings.

THE FREAKS OF THE FUNGI.

SIR,—Although the *Builder* has repeatedly furnished information on this topic, it would seem that the knowledge will again and again be sought by those who wish to do without professional aid, or who have ignored it originally. Let that class of persons be informed plainly and unmistakably that bad construction and bad materials are the chief causes of dry-rot in timber. Unseasoned wood, timber in which the sap is retained, will, when put into situations having no access of air, generally exhibit the fungi known as dry-rot. Ground-floor joists and flooring, skirtings, plugging, and even joists raised on dwarf walls, will be liable to dry-rot if under-ventilation is not provided. If sea-sand, sea-water, or saline substances get into the composition of the mortar or brick, this, where there is a want of ventilation, will produce dry-rot. Many of our brick clays, particularly those near the sea-coast, are strongly impregnated with salts or saline matter, and brick clays of this nature should be turned up and exposed to the action of the winter months, to prepare them for fitting use in brick manufacture. If it be in a ground floor the dry-rot is discovered, a very good remedy is to excavate the earth for some depth beneath, and fill with foundry-ashes (but not house-ashes); if these cannot be had, quicklime will be a good substitute.

The fungi sometimes present a yellow colour; on other occasions, a white mould will be spread about by a plant like a sea-weed, or, as some say, a vine, in shape. If dry-rot shows itself in a damp closet or pantry, the inside of the china or delf lying there will be coated perhaps with a mould, or a fine powder like brickdust.

Several anti-dry-rot solutions have been recommended during the last quarter of a century, of more or less efficacy; but none of them have turned out completely satisfactory. Unless the timber previously, or at the time of putting into use, be treated with these solutions, it can never be properly done afterwards. The timber, of course, should be seasoned before subjecting it to any of these processes; a solution of chloride of zinc or a solution of bi-chloride of mercury forced into the pores of the wood by the air-pump. This latter is the well-known and, at one time, much-used method of "*Kyanising*," called after its introducer. Creosoted timber is now much used for railway and tramway sleepers, and in other situations; but it is out of place for church or open timber roofs and varnished work. It is a grave question, too, if it is not highly injurious to the lasting qualities and tenacity of the wood, as well as those other solutions spoken of. In timber exposed to the action of water, or buried in the earth, something may be said in its favour.

Indeed, the freaks of the fungi are so numerous and so variable, that they resemble the whims of some of our churchwardens, who would rather pray for the cure than pay for the prevention of the disease.

A CHURCH BUILDER.

THE NEW SEAMEN'S ORPHAN INSTITUTION, LIVERPOOL.

THE designs of this edifice, the chief stone of which has just been laid, have been prepared by Mr. Alfred Waterhouse, and are to be carried out by Messrs. Haigh & Co. A façade nearly 300 ft. in length will be so situated as to present an oblique perspective from West Derby-road, the building itself facing about south-west. The elevation will be varied in outline, and, indeed, the architectural effect will depend more upon its grouping than upon elaboration of details. At the southern extremity of this principal façade, and standing in advance of the rest of the building, will rise a tower, 25 ft. square, and about 120 ft. in height. Towards the centre of this front will be the next most prominent feature in the elevation—the block containing the dining-hall, the principal apartment in the building. The roof of this block is to be taken to a greater height than the adjoining roofs, and, to resist the thrust of the principals, buttresses will project between the windows. These windows are to be over 16 ft. in height, and divided into three lights, both in width and height, the head of each light being trefoiled. The materials to be used are grey bricks with red Runcorn stone dressings. Over the window-heads, which are generally square, there will be relieving arches in red bricks, and at the eaves of the roof a cornice of the same material. The roofs will be covered with slates. The building will be generally four stories in height, and consist, roughly speaking, of a main block running parallel with the road, and at either end a wing at right angles with the main block. The basement floor, which will be level with the surrounding grounds, will contain in the northern wing a covered play-ground for boys, about 90 ft. by 30 ft.; in the south wing a similar play-ground for girls, and the laundry department; and in the central block, the kitchen and other needful offices; a swimming-bath, and a boys' workshop of about the same dimensions as their play-grounds. The main floor is to contain the dining-hall, 70 ft. by 36 ft. by 30 ft. high; two school-rooms for boys over their play-ground and workshop respectively. A similar school-room for girls, and the necessary accommodation for the administrative department are to be provided. The first and second floors are mainly appropriated to dormitories; there being four dormitories for boys and two for girls, each dormitory being capable of accommodating fifty children. Thus accommodation will be provided for 200 boys and 100 girls. The building will be warmed throughout by the hot-water system of Messrs. Hayden, of Trowbridge.

The estimated cost of the building and furniture is 27,000*l.* The corporation gave the site, a plot of 7,000 yards on the boundaries of Newsham Park.

No. 36, LATE 118, SAINT MARTIN'S-LANE.

OBSERVING in the *Builder* of September 16th that you notice the change of site of the Provident Institution Savings Bank to other premises in the same locality, I take the liberty of calling your attention to my notice, in the front page of the same number of the *Builder*, as to the removal of a "London landmark," not only from the fact of the premises I have parted with to the Provident Institution having been in the glass trade for a century and a half, and since 1746

occupied by my great-grandfather, grandfather, father, and myself, in succession, but from the associations connected with such occupation.

In Walpole's "Anecdotes of Painting," article "Peter Oliver," vol. ii., pp. 29, 30, he mentions my great-grandfather (Palmer) as purchasing parcels of painted glass (till then a rarity) from one Asciolto, an Italian, who brought them from Flanders (1753); and again, in a letter to Sir Horace Mann (1754), Walpole relates an amusing anecdote of a visit he paid to St. Martin's-lane, when he called to settle with my great-grandfather for the painted glass he supplied to Strawberry Hill. I have heard my late father speak of visits paid on business by Sir Thomas Lawrence, Jackson, and G. Morland; and during the present century (as connected with metropolitan and other improvements) we had frequent communications with Sir John Soane, Sir R. Smirke, Mr. Nash, and others, down to the latest of the Classical school, Sir J. Pennethorne.

PHILIP PALMER.

THE TRADES MOVEMENT.

Newcastle-upon-Tyne.—The critical position of the strike at Newcastle for the nine hours has created considerable uneasiness amongst the London society engineers, and it has been generally reported through the London shops that, disheartened by the daily arrival of so many skilled mechanics from the Continent, a considerable number of the non-society men who have been on strike had returned to work upon the old terms, being induced to take this step, not from want of present support, but from the knowledge that should the struggle result in favour of the masters, and the strike be declared at an end by the committee, they would be left to their own resources without employment, while the society men would continue to receive their weekly donation money from the fund of the society until they obtained employment in their old shops or elsewhere. The committees, both in London and Newcastle, are using every effort to counteract this feeling, and state that the number of old hands who have returned to work are so few as not to be likely to have any appreciable effect upon the result of the strike. They admit, however, that great danger exists from the number of foreign workmen daily arriving, and that the strike will be a failure unless this immigration can be stopped. Under these circumstances, several of the leaders are considering the propriety of offering a compromise, and a suggestion made by Mr. George Potter, that while the masters should concede the nine hours, the men should give up half an hour per day in wages, has been received with much favour as an honourable way of settling the dispute. Another element of discussion has also arisen. As a body, the Engineers' Society are strongly opposed to political feeling being mixed up with their trade disputes, and the proposal of some of the political leaders to hold a demonstration in Trafalgar-square in support of the strike has been violently opposed in the committee, and given rise to stormy discussions, in which much personal feeling has been indulged in. The committee refused to find the money to pay the expenses of the meeting.

At a meeting of the Labour Representation League, the following resolution was carried:—

"That in the opinion of this meeting the conduct of the Newcastle employers in introducing foreign labour for the purpose of defeating their workpeople in their present struggle for the nine hours, is fraught with national danger, inasmuch as it tends to denationalise English workmen by driving the flower of our artizans into emigration; and this meeting denounces such conduct as a dangerous political precedent, giving countenance to the importation of foreign mercenaries for political and social purposes, which has been so severely denounced by the press and middle class during the last few years."

The joiners' strike in Newcastle for the nine-hours movement is not yet at an end, as has been reported. Sixty-seven employers conceded the demand of the men, but thirty-two refused. The master house-builders who have conceded the nine hours to their men, have held a meeting in the Neville hotel. They met to hold an interview with the Master Builders' Association, working on the ten hours, and the men on strike. The members of the Master Builders' Association did not attend, however. The meeting was held in compliance with a resolution come to at a preliminary meeting held in Gateshead, viz., "that the master builders who have conceded the nine hours endeavour to ascertain from the secretary of the Masters' Association the names of the whole of the masters who are working on the old terms, and the number of men employed by each, and those who are working fifty hours per week, men receiving 28s. per week, only to be counted; and if the majority of the men working are on the old terms, we agree to give our men notice to return to the old terms." At the meeting it was found that there were 376 working for the nine hours, and 266 for the ten hours. It was thereupon resolved that there was a necessity in favour of shortening of the hours of labour and their adherence to it; and the chairman, in putting the resolution to the meeting, said he believed they would all agree with him that the nine-hours masters had succeeded in getting the best workmen, and could do the work as cheaply as the ten-hours masters.

Leeds.—The marble masons and polishers employed by Messrs. Welch, of Goodhouse-lane, having applied for a reduction of the hours of labour from 58½ to 56 per week, have been met by their masters with a lock-out, their money having been paid with the intimation that their services would no longer be required. Some of the other masters in the town have agreed to the reduction. The plumbers are about to ask for an increase.

Glasgow.—At a meeting of the Clyde Engineers' Association, held at Glasgow, it was resolved, taking into consideration that the carpenters' strike continued in the Glasgow district, notwithstanding the advance of wages offered at Greenock and other places at which they work, that a lock-out of all the carpenters of the Clyde should take place, unless the strike was brought to an end.——There is just now a disposition among engineers here to strike for a ten-hours day, with which (instead of the present long stretches of fourteen and twenty-one hours a day, several times weekly) they would be well satisfied. It so happens that the trade, as connected with shipbuilding, is extremely good at present, and in several establishments the men must work till ten p.m., or all night frequently. Against this excessive overtime there is a feeling arising. Taking into consideration the number idle at Newcastle, and the number over-employed here, the state of matters looks anomalous; and the employment of the strike men by the Clyde firms would settle matters in both places in the meantime. In connexion with the extensive works of Randolph, Elder, & Co., there is another grievance anent the overtime question. If one of their workers is behind time,—although only fifteen minutes,—in the morning, and "the shop" works late that night, the late hand loses all extra time and allowances for overtime, besides his late time in the morning. That is, suppose a man works from 6 a.m. till 10 p.m., he is paid fifteen hours and 6d. for "allowance;" but should he only work from 10 a.m. till 10 p.m., he is only paid eleven hours and no "allowance," so that for being late three hours he loses four hours and 6d. Against this rule a number of the men employed in the works at Centre-street struck, leaving the shop at six o'clock in a body; and unless some alteration is made a general strike is regarded as by no means unlikely.

Brussels.—The employers have accepted the compromise proposed by the engineers—ten hours' work, with an additional 50 per cent. pay for labour beyond that time. The men have everywhere resumed work.

Berlin.—The masons' strike having ended with the defeat of the men, and a strike of the pianoforte-makers with the almost immediate submission of the masters, a very confused struggle in the cabinet-makers' trade now occupies public attention. The cabinet-makers' trade is the most extensive in Berlin, except that of the engineers. The Berlin cabinet-makers work for the whole north of Germany, and, to a large extent, even for exportation to Poland and Russia. Their secret is extreme cheapness, brought about by division of labour, carried to its utmost limit. They work chiefly in oak, in mahogany, in birchwood, and in pine. In walnut and in rosewood they have not been able to get the mastery of the other German cities. The workshops are generally not large, yet a great many of them employ steam machinery. The work is all paid for by the piece, the same man being always engaged on the same article. Wages, measured by time, vary greatly; for very many articles they are decidedly low. The masters have adopted a quite different proceeding from those in other trades to meet the strike. They are availing themselves of a provision of the law, treating of the contract between master and man, for compelling the men to complete the work,—so many dozens of chairs, &c.,—which they had consented to do. The law provides that the working man who refuses to do what he has undertaken to do, either by oral or written contract, may be imprisoned for a fortnight. The provision of the law has now been put to the test in a series of cases by the masters, and has been found to answer their purpose. Yet it has become but too evident that the odious nature of this compulsion to work has added to the bitterness of feeling between the two parties.

ERECTION OF A LARGE MILL.

IN Brighouse, last week, the foundation stone of what is to be one of the largest mills in Brighouse was laid by Mr. George Hepworth, architect, by whom the plans and specifications have been drawn. No little interest was added to the occasion from the fact that Mr. Hepworth that day was seventy-three years of age, and appeared hale and hearty. Further to mark the event, he was presented with a handsome silver trowel, the inscription on which stated that it was presented as a mark of esteem on reaching a good old age. Mr. Hepworth, in reply, remarked that it was an uncommon and novel duty which fell to his lot that day, being entrusted with the privilege of laying the foundation-stone of another of those hives of industry which had added so much to the prosperity of Brighouse, in which he had lived exactly seventy-three years that day. He was much pleased and gratified with the mark of respect which had been shown him, and however many years might yet be added to his life, he should bear a grateful remembrance of that day's event. With respect to the building just commenced, he trusted it would be completed without accident to any, and that its erection would be creditable alike to himself and to the contractors, prove a source of wealth to the proprietors, and afford a comfortable livelihood to all who should be employed therein. The mill, which is the property of Messrs. Ormerod Brothers & Cheetham, silk-spinners, will be 168 ft. long, 53 ft. wide, and six stories high. It will contain upwards of 5,000 yards of flooring. The chimney will be 51 yards high. Altogether the contract is the largest ever let at one time in Brighouse. The following are the contractors:—Mr. Jas. Dyson, mason work; Mr. Thos. Bottomley, carpenter and joiner; Mr. C. H. Broughton, ironfounder; Mr. D. Smithies, slater; Mr. J. Shaw, plumber and glazier; Messrs. Hirst & Barraclough, painters; Mr. Joseph Wood, plasterer.

THE MONT CENIS TUNNEL.

A CORRESPONDENT of the *Journal des Débats* thus describes this newly-inaugurated and remarkable triumph of engineering and geological science:—

What engineer did not smile incredulously, fifteen years ago, when it was proposed to pierce the Alps, to cut through from side to side of a mountainous mass of nearly 3,000 mètres in height, and more than 12,000 mètres in thickness? What a dream! Where will you find air for the workmen 2,000 mètres under earth? How will you break the rock for such a length? Half a century would not suffice; and if the work of piercing is begun at both ends, how is there any certainty of meeting? Would not the workmen soon get astray amongst those masses of lime and quartz? Objections of all kinds were not wanting. To-day the dream has become a reality. The mountain is perforated, and it has only required thirteen years to finish this unparalleled task. The tunnel, begun at the end of 1857, is absolutely finished, and ready for use. But what progress has been made in the art of mining during ten years! By the ordinary means of piercing in a rock of average hardness, an advance of 17 mètres per month is all that is reckoned on. With the method employed in the Alps, they reached the rate of 70 to 75 mètres. The force of the miner has been more than quadrupled. In 1858, 250 mètres of the tunnel were excavated; in 1870, 889 mètres. The piercing of mountains, yesterday considered almost impossible, has now become mere child's play for the engineer. With the modern appliances, with skilled and experienced workmen, he can excavate the calcareous rock his two kilomètres a year. Henceforward it is only a question of time and money. The technical problem is solved.

After a long survey of the mountain, it was decided that the most favourable spot and the most direct line for the perforation was from

Fourneaux, Savoy, to Bardonneche, Italy. The cutting at the shortest is from N. 22 deg. W. to S. 22 deg. E., and traverses the body of Mont Thabor by the Col de Fréjus. It does not therefore pass near Mont Cenis, which is situated more to the north. The title of the Mont Cenis Tunnel has never been correct. The St. Michel Railway has been prolonged as far as the tunnel. Like the Fell Railway, the new line follows the Valley de l'Arc. The slopes have been modified by the aid of embankments, and the curves by the use of some underground passages. It was necessary to carry the line on far beyond Fourneaux, and to bring it back upon itself, the length of the mountain making it describe a curve to get over the great difference of level between the valley and the entrance to the tunnel. The station of Modena will be on the shore of the Torrent de l'Arc, at 100 mètres from the arch of the tunnel. The travellers can therefore contemplate at leisure the passage (of about eight miles, be it remembered) through which they are to traverse the heart of the mountain while they are describing this curve. On the Italian side the junction is complete. The old railway line from Turin to Susa has been prolonged to the entrance of the tunnel at Bardonneche.

The substance of the rock was perforated at the thickness of 12,233 mètres. The entrance of the gallery is, on the French side, 1,202 mètres above the level of the sea, and on the Italian, 1,334 mètres. There is, consequently, between the two extremities of the subterranean passage a difference of 132 mètres in level, which has been adjusted by a corresponding slope. The profile of the mountain may be described, on leaving Bardonneche, by a curve at first slightly raised, which is raised gently to a distance of 4,000 mètres from the entrance. At that point it is sharply raised, and rises almost vertically to a height of 2,969 mètres above the sea. This is the culminating point. It does not correspond with the centre of the tunnel, but is some hundred mètres nearer the French side. The curve then slopes down rapidly to Modena, and terminates almost perpendicularly at Fourneaux. Such is the sketch that would be obtained by cutting the Alps according to the axis of the gallery. The rock during the passage is varied in its character. The opinions of the geologists have been confirmed at all points as to the composition of the mountain, and there is much to excite wonder and admiration in the exactness with which science has shown the thickness of the different soils that the engineers have had to perforate in the mountain. It was calculated that there were 8,000 mètres of schistone and limestone on the Italian slope, and in reality they found 8,000 and some hundred odd mètres of limestone. Farther on, in exact conformity with the calculations, they came across 356 mètres of compact lime, then 388 mètres of quartz, and 2,096 mètres of anthracite, on the French slope. A better prediction could not have been made had the mountain been transparent, and it is altogether a great triumph for the geologists.

We early gave particulars of this remarkable tunnel from personal examination.

CUMBERLAND AND WESTMORELAND ANTIQUARIAN AND ARCHÆOLOGICAL SOCIETY.

A MEETING of the members of this society, in conjunction with the Durham and Northumberland Archæological Society, took place last week at Kirkby Stephen. About noon the members of both societies assembled at the railway station, and proceeded in conveyances to Wharton Hall. Afterwards, after thoroughly examining the hall, some of the visitors returned to Kirkby Stephen, whilst others went to visit the ruins at Pendragon, on the banks of the River Eden, where tradition tells us the father of King Arthur lived. The members and their friends met at Kirkby Stephen Church, which is now undergoing restoration. A paper, touching the history of the building, was read by the Rev. J. F. Hodgson, of Staindrop. From Kirkby Stephen the members proceeded to the ancient castle of Brough, formerly one of the seats of the Viponts. With the inspection of Brough Castle and Church the visiting for the day ended, and the party returned to Kirkby Stephen. It was the intention of Mr. and Mrs. Simpson to entertain the members of both societies at a *soirée* to be held in a marquee which had been erected for the purpose; but owing to the serious illness of Mrs. Simpson, the intention had to be abandoned. In the evening, however, the members met at dinner, at the King's Arms Hotel. Mr. Mason, of Kirkby Stephen, presided. Next day the members of the societies left Kirkby Stephen for Appleby. On reaching the town, they proceeded to the church, and under the guidance of Archdeacon Boutflower, examined closely the objects of interest in and around it. From the church they proceeded to Appleby Castle, the residence of Admiral Elliott, who received the visitors with the utmost courtesy. Previous to examining the interior of the tower, the Rev. C. F. Weston read a portion of a pamphlet upon Appleby Castle, prepared a few years ago by the Rev. J. Simpson, who was unable to leave Kirkby Stephen, owing to the death of Mrs. Simpson. The members returned to the King's Head Hotel, where luncheon was provided for them. After luncheon they left Appleby in conveyances for Brougham Castle, Yanwath Hall, and Penrith, for the purpose of inspecting the interesting prehistric remains in the immediate neighbourhood of these places.

THE NEW BUILDING OF THE BRADFORD MECHANICS' INSTITUTE.

A LARGE portion of the ground floor of the newly-erected building is occupied by shops, which, in fact, take up the whole of the three open sides on that floor with the exception of the space occupied by the entrances. Of these there are three; the grand entrance in the Bowling-green, and two others, of equal importance so far as their external appearance and size are concerned: one of them opening into Tyrrel-street, and the other into New Market-street. A wide corridor runs through the building from the Market-street to the Tyrrel-street entrance, and access to this corridor can also be gained from the grand entrance. The general arrangement of the building is this: the section which is on the inner side of this central corridor is chiefly devoted to the lecture-hall, while the other portion, parallel with the Bowling-green, is arranged for class-rooms, news-room, and library. The great difficulty with which the architects have had to contend in contriving the internal arrangements has been to provide a sufficiently commodious lecture-hall.

The new lecture-hall is considerably larger than the lecture-hall of the present Institute, being especially of much greater height. A spacious platform is placed against the party-wall which divides the Institute building from the pile of shops and offices next to it. The wall at the back of this platform is relieved by four pilasters, supporting an ornamental cornice. The platform, which is rather more elevated than is usually the case in such halls, contains a well, into which a pianoforte can be lowered. Immediately in front of it is a level space which will be known as the area of the hall. It will be seated with stalls constructed in the same way as what are known as the balcony-stalls at the Royal Albert Hall, and at more than one of the London theatres: the seats lifting up so as to enable persons to pass to seats in the middle of a row without real inconvenience to anybody. It is expected that this area will seat about 360 persons. Behind it are some tiers of seats rising one above another to a considerable height; so high, indeed, that access to them is gained from the second-floor corridor. This part of the auditorium will be known as the balcony. Above it again is the gallery, which goes round the three sides of the apartment, much as the gallery of a chapel. It is of great size, being constructed to accommodate 600 persons. The front of the gallery is being ornamented with relief work, in Louis Seize style, and in a patent material which has the appearance of cement. The gallery entrances open from the central corridor on the third floor. Thus there are no fewer than five entrances to the hall available for the audience, and, by an arrangement of doors in the corridors, any one of these can be shut off or confined to one particular class of the audience. The platform can be ascended from the body of the hall, but two doors open on it, one at each side, from ante-rooms. In the daytime the hall is lighted by the third-story windows of the building, in Tyrrel-street and New Market-street. The ceiling is elaborately ornamented. In the middle is a large square, within which is a circle, and in the centre of this is a ventilating shaft which passes through the class-rooms above to the roof. The centre of the ventilating shaft is spanned by one of four great iron lattice girders which carry the weight of the upper portion of the building, and of the roof. From this girder will depend the chandelier—one of an ornamental description, with two rings of gas-jets, and which will have from 140 to 150 lights. The hall is intended to accommodate an audience of 1,200 persons, and it is believed that its acoustic properties will be good.

The art and other class-rooms are in the highest story of the building. As below, a central corridor divides the building into two sections. On the bowling-green side, the entire area is occupied by one large room, the art class-room. It is of precisely the same dimensions as the news-room, which is below, and is lighted from the roof. The roof is open, and the heavy wooden beams are connected and strengthened by iron tie-rods. The room will be divided by movable wooden screens into separate departments, where the different kinds of drawing,—elementary, light and shade, drawing from the round, &c.,—will be taught. The space on the other side of the corridor, and over the lecture-hall, is divided into four large class-rooms, in which will be carried on the elementary classes forming the night-school proper of the Institute. The two middle ones are the largest; the other two being shortened by the space appropriated to lavatories, closets, &c. Similar conveniences are provided on the lower stories, near the entrance to the lecture-hall. The four large class-rooms will accommodate altogether 350 pupils. There are arrangements for ventilation in these, as in the other rooms.

A skylight in the corridor affords a view of the top of a ventilating-shaft, which, coming from the bottom of the building, projects some 12 ft. outward above the roof. Adjoining this, there is to be a sort of observatory, where various meteorological observations will be taken.

The cellarage is extensive. Here are boilers and furnaces, by means of which the building will be warmed throughout by hot air and hot water. Here also is the space underneath the lecture-hall,—a large room more than 20 ft. high, but unfortunately very imperfectly lighted in the daytime. It might be turned to account as a gymnasium. Great progress is now being made with the completion and furnishing of the building; but a good deal remains to be done, if the Institute is to be completed on the day fixed for opening,—October 2nd. The contractor is Mr. Neill. Messrs. Andrews & Pepper are the architects.

CHURCH-BUILDING NEWS.

Windermere.—The new chancel of the parish Church of Windermere has been consecrated. Messrs. Paley & Austin, of Lancaster, architects, have carried out the alterations, the cost of the whole being upwards of 4,000*l.*, which is to be defrayed by subscription. The church is interesting from its erection with the rubbly building material of the district. The whole of the nave and aisles have been furnished with open oak seats; the chancel has been supplied with a new altar-table, six rows of choir-stalls, pulpit, and lectern, all of the same material and design. The organ, also new, has been placed at the east end of the north aisle, being enclosed from the choir by a light open oak screen, and a new vestry has been built to the rear of the organ, and opening into the north aisle by a screened arch. The old oak roof has been cleaned and repaired. The removal of the west gallery would allow the lower portion of the tower being thrown open, and the hidden west window exposed. A reredos of alabaster, carved and inlaid with mosaic panels bearing the emblems of the Evangelists, has been presented to the church by Mr. W. H. Schneider, of Bellfield. The woodwork of the nave has been executed by Mr. Blades, of Lancaster; of the chancel, by Mr. Brownrigg, of Bowness; and of the roof, by Mr. Holmes, of Bowness; the stonework being by Mr. Pattinson, of Bowness. The builder of the new organ was Mr. Edward Wadsworth, of Manchester.

Beer Ferrers.—The ancient church of Beer Ferrers has been re-opened after a restoration, including new aisles. During the progress of the restorations, a number of interesting details were discovered. A piscina and sedilia were found in the chancel, an aumbry in the chancel aisle, and in the north transept a shelfed piscina, and a hagioscope. A string course against the eastern wall of the transept marks the spot where the foundation priest's altar stood; and a feature in the other wall, a Mediæval fire-

place, appears to indicate that the nightly duties were found rather irksome. What may have been the slab of the chief altar—a huge carved stone, is now placed in the wall behind the communion table, forming a reredos. The ancient roofs have all given way to others of later construction. Those of the aisles and transepts are plastered. Those of the nave and chancel are new and open timbered. Care has been taken of the ancient interior woodwork; and the old bench ends, of which there are many, have been repaired. They are chiefly carved in panels, with flowing decorated tracery; and upon one the arms of the Ferrers—three horse-shoes,—are distinctly to be seen. The lower part of the rood-screen is likewise retained. On its panels are traces of the saintly figures which were emblazoned thereon. The rood staircase remains, but is closed. New stalls have been fitted in the chancel, and new seats in the transepts, all of pitch pine varnished. The stonework has been cleaned, the walls replastered, the roofs re-slated, the windows reglazed, and the rough-cast outside repaired and coloured. The walls being built of slate rubble, it was not easy to treat them in any other way. The tracery of the older windows is of Roborough stone; the mullions and the arcades of granite; the old font is of Hurdwick stone, and the canopy of the Champernowne tomb, with part of the other interior stonework, is of polyphant, and in good preservation. Some of the old windows, long stopped up, still remain so. The characteristic features of the restoration are substantiality and economy, governed by a desire to preserve all that is worthy of preservation. The works have been executed from the designs of Mr. J. Piers St. Aubyn, of London, by Mr. P. Blowey, of Buckland Monachorum.

ROMAN CATHOLIC CHURCH-BUILDING NEWS.

"*Stanbrook.*"—With reference to paragraph under the above heading in your paper of the 16th instant, as the manufacturer who supplied this pavement, I beg to state that the correct style of my firm is "Robert Minton Taylor," *not* "Minton, Taylor, & Co." The pavement is composed of *tiles*; the bands of the patterns being formed of glazed tiles, and not of marbles.

ROBERT MINTON TAYLOR.

SCHOOL-BUILDING NEWS.

Penzance.—A new Wesleyan Sunday-school in St. Clare-street, Penzance, has been opened. The prison premises have been converted into the school. The cost was 200*l.* Tenders for alterations, &c., were invited, when Mr. Henry Carne's tender of 120*l.*, for carpenter's work, and Mr. Philip Thomas's, of 100*l.*, for mason's work, were accepted. Under the superintendence of Mr. John Trounson, as architect, the undertaking has been brought to a successful issue. The room is 44 ft. long, 33 ft. wide, 16 ft. from floor to ceiling, and has been constructed in every way capable of conducting a moderately large school with comfort. The front, back, and end walls of the old prison have been raised, and the cells occupying the inner space have been demolished. Four cells in the rear of the building have been converted into convenient class-rooms; necessary offices have been provided; and all sanitary arrangements (as to ventilation, &c.) have been attended to. The room is lighted by three large windows in front and two in the rear; and, altogether, the premises are capable of accommodating about 300 children.

Deal.—St. George's National Schools, Deal, situated in Middle-street, Deal, in Kent, have been formally opened. The buildings have been erected from designs prepared by Mr. William E. Smith, of London. Messrs. Gibbons & Collins, of Deal, have executed the works, which have amounted, including the purchase of an additional site, to above 1,000*l.* The boys' and girls' schools are each 40 ft. long by 20 ft. wide, and each school has a class-room. The style adopted is plain Gothic, and the materials are red and yellow brickwork, with stone dressings. The building has open timber roofs, stained and varnished. Ample playgrounds are provided.

Reading.—The new Grammar School has been opened by the Lord Chancellor, in the presence of a numerous assemblage of ladies and gentlemen. The foundation-stone was laid by the Prince of Wales on the 1st of July, 1870. The architect was Mr. Waterhouse, and the builders were Messrs. Parnell & Son, of Rugby. The school fittings were supplied by Messrs. Sidebotham & Co. A sum of 5,000*l.* was required to purchase the fee of the 10 acres which comprise the school site and grounds; and the contract for the erection of the buildings,—and for which they will be completed,—amounted to something under 20,000*l.* The style is Elizabethan, and the structure is of red and brown brick. As seen from the London-road, the cricket-ground is in front of it. There is at present accommodation for 60 boarders and about 300 day-scholars, and additions now in contemplation, in the shape of master's house, will allow of the reception of a larger number of boarders. The buildings comprise a school-room, 82 ft. by 26 ft.; ten class-rooms, one head and second master's private houses, &c.; and it has accommodation for sixty boarders. Each boy has a separate dormitory, and there are rooms for hospital purposes cut off from communication with the rest of the building. The school stands in the "open" to the north-east of the town, in a picturesque and healthy position.

Gloucester.—The chief stone of St. Nicholas's Schools has been laid. The cost of site, school, and furniture is expected to be 1,800*l.* Mr. Jones is the architect. The buildings have been designed in two stories. The ground-floor contains the girls' school, 40 ft. by 20 ft., with class-room adjoining. The infants' school will be at right angles to the girls' school, and will measure 35 ft. by 20 ft. 6 in., and both schools will be 14 ft. high. The upper floor contains the boys' school, 62 ft. by 20 ft., with class-room, 20 ft. by 14 ft. 6 in. The height of this story will be 13 ft. to the wall-plates. The roof will be ceiled to the underside of the rafters, with the principals and purlins showing. Fresh air will be admitted into the buildings by openings under the floors and by the windows. The warm air will escape through ventilators in the roofs and walls. The schools will be warmed by open fireplaces. The boys and girls will have separate entrances in Quay-street; the infants' entrance will be in Upper Quay-lane. The bell will be hung over the gable in the Quay-street elevation. The inside of the walls will be painted and limewashed, and each room will have wall-lining of wood, 4 ft. 6 in. high. The floor of the boys' school will be plugged to prevent the noise disturbing the occupants of the lower rooms. The schools will accommodate about 330 pupils. The elevations will be plain, with no attempt at ornament, the walls being built of red brick, relieved with strings of black and white bricks; and the roofs will be covered with Broseley tiles. The usual offices have been provided.

Bishop's Stortford.—The Education Department has just sanctioned the plans for the new boys' and girls' schools in St. Michael's parish, and has approved the title of the proposed site. The grants from all sources amount to 585*l.* The Building Committee have considered the tenders, and accepted that of Mr. Cornwell, which was the lowest, for 980*l.* This sum does not include the desks and other apparatus, or the making of the playground; and the whole expenditure, including the purchase of the site, the actual legal disbursements, and architect's commission, cannot be estimated at less than 1,750*l.*

St. Alban's.—At a meeting convened by the trustees of the Abbey National Schools, to consider the advisability of continuing the present system of parochial schools, and what steps should be taken to increase the existing accommodation for educational purposes, it was resolved "That in order to meet the requirements of the Elementary Education Act, 1870, it is necessary that greatly enlarged school accommodation should at once be provided." It was resolved also that a committee should be appointed to assist the existing trustees in carrying out the object in view.

Tarporley.—The school of Lord Crewe, built at Spurstow, on the verge of Haughton Moss, is rapidly being completed. The buildings, which comprise schoolroom, 38 ft. by 18 ft.; classroom, 13 ft. by 12 ft.; and mistress's residence, with living-room, 12 ft. by 12 ft.; and kitchen, 11 ft. by 9 ft.; with three bedrooms on second floor, and the usual outbuildings, are in the Perpendicular style of architecture. The materials used for the construction are local red bricks relieved with diapered patterns of Staffordshire blue bricks, and freestone from the Burwardsley Quarries is freely used in the window-dressings, &c. The schoolroom, which is lined internally with blue bricks to the height of the window-cills, is lighted by three two-light traceried windows in the side wall, and a four-light window in the gable end, divided into two heights by transomes, the upper part being filled with tracery characteristic of the period. The roof is open-timbered, with three principals of the hammer-beam description supported on moulded stone corbels, and is constructed of pine, slightly stained and varnished, the whole being covered with grooved and tongued boarding, on which the tiles are laid in ornamental bands of different colours, felt being placed between the boards and tiles. The entrance to the schools is by means of an outer porch, over which is a clock-tower, carried up above the ridge of the main building, and surmounted by an octagonal high-pitched roof, with overhanging eaves, carried by carved brackets springing from a moulded stone string-course. When complete this roof will have ornamental iron finials. The mistress's residence is carried out in the same style throughout, with ornamental open-timbered porch to entrance, the internal fittings being of pine, stained and varnished to correspond with the woodwork in the school. The warming of the whole is by means of open fireplaces, the chimneys being constructed with projecting breasts with stone weatherings; the shafts, which spring from splayed and throated stone bases, being surmounted by ornamental moulded caps. The whole of the roofs are finished with gable-boards, which project beyond the face of the walls. They are pierced with tracery, and have octagonal finials, with moulded caps and pendents. The windows are glazed with lead lights of diamond pattern, those to the schoolroom having a margin of cathedral-tinted glass. All the principal floors are boarded, and the ventilation is carried out by means of wrought-iron casements in the windows, hung on swivels, the foul air from the schoolroom escaping by means of piercings in the roof, which communicate with four louvres, with trefoil in each, covered with perforated zinc. The works are being carried out by Mr. John Stringer, of Sandbach, at the sole expense of Lord Crewe.

Romsey.—The foundation-stone of a new school-house has been laid here by the Hon. Mrs. Cowper-Temple. The old school (built by Lord Palmerston) was greatly dilapidated. The Right Hon. W. F. Cowper-Temple defrays the cost of the erection of the school, which is to be devoted to the education of boys alone. The plan is by Mr. William Eden Nesfield, architect, London, and the building has been undertaken by Mr. George Wheeler, of Romsey. The site, given by Mr. Fleming, is in North Gaston, between the railway station and the town. The dimensions of the school-room will be 71 ft. long, 19 ft. wide, and it will be lighted by nine windows, the entrance porch at the south-west corner having a bell-turret. At the south angle the school-house will be situated: it will be two stories high, and supplied with all domestic offices. The whole block will be built of red bricks, with Bath stone gables, and the bellcott will also be of Bath stone. The foundation-stone is at the south-west corner.

Sittingbourne.—In order to comply with the requirements of the Education Act new schools are to be erected for the Trinity District, on a site which is the gift of the Rev. G. S. Simpson and Mr. P. Simpson. The contract has been taken by Mr. Seagar, of Borden, and the work has been commenced. The Government has made a grant of 364*l.* towards the building fund. The new schools are intended to accommodate 300 children.

Miscellanea.

State of the Wandsworth Drainage.—Mr. F. W. Goddard, a resident in Wandsworth-road, states in a letter to the Lambeth Vestry, that having recently had the misfortune to lose a son from scarlet fever, he set about to see if he could ascertain the cause of the prevalence of the disease in his neighbourhood. He found that zymotic diseases were in existence to a very alarming extent. Some of the houses were not drained into the sewer, which has been completed for over five years, and the ordinary sanitary requirements in dwellings were generally neglected. The neighbourhood has been a known pestilential den for over thirty years, and in 1851 the cholera raged there in all its virulence. Members of the vestry speak of taking the management of sanitary affairs out of the hands of the General Purposes Committee and transferring it to a special sanitary committee.

The New Town-hall, Wirksworth.—The chief stone of this building has been laid, with Masonic ceremonial.

Birmingham Architectural Society's Excursion. — The annual excursion of the members of this society has taken place. The party visited Albrighton, Tong, Weston, Lilleshall, Sheriff Hales, and Shiffnal. On reaching Albrighton, a drag and four-in-hand were waiting, and they proceeded to Albrighton Church, where the Early Norman work in the tower, and the tomb of Sir John Talbot in the chancel, were examined and discussed. A pleasant drive brought the party to Tong Church, where they were met by the Rev. Mr. Lawrence, who conducted the visitors through the church, which is believed to be the one which Dickens described, and Cattermole drew, in connexion with the story of "Little Nell." The party then went on to Weston Hall, the seat of the Earl of Bradford, which had been courteously thrown open to the visitors, who also went through the church. Returning along the line of the Watling-street, the party proceeded to Lilleshall Abbey, which they left reluctantly to proceed to Sheriff Hales Church and Shiffnal, where dinner was provided at the Star Hotel, the president (Mr. Y. Thomason) in the chair. After dinner the party proceeded to the church, which was lighted up specially for their inspection, and after a full examination of the recent restoration by Mr. Gilbert Scott, the return to the station was completed, and the party reached Snow-hill soon after ten p.m., after a very pleasant and instructive day.

Papers for the Institution of Civil Engineers.—The Council of the Institution of Civil Engineers have issued a list of subjects on which they invite communications. It includes the following:—On the Application of Graphic Methods in the Solution of Engineering Problems; an Experimental Inquiry into the Strains upon Arched Ribs, variously loaded, to ascertain the agreement between Calculation and Experiment; on the Methods of Constructing the Foundations of some of the principal Bridges in Holland and in the United States; on the most suitable Materials for, and the best Mode of forming, the Surfaces of the Streets of large Towns; on the Advantages and Disadvantages of Subways, for Gas and Water Mains, and for other similar purposes; on the Theory and Practical Design of Retaining Walls; on the Use of Concrete, or Béton, in large masses, for Harbour Works and Monolithic Structures; on Excavating by Machinery, with a description of any Excavating Machines which have been brought into successful practical use; on the Water-supply of Towns, including a description of the sources of supply, of the different modes of collecting and filtering water, of the various incidental works, of the distribution to the consumers, and of the general practical results; on the Theory and Practice of the Modern Methods of Warming and Ventilating large Buildings.

Proposed Public Hall for Handsworth.—A preliminary meeting towards the erection of a public hall on the site of the old Soho Gate Toll-house, has been held. Mr. Blackham laid before the meeting a plan and elevation, prepared by Mr. W. H. Ward, of Birmingham, architect. Mr. Ward proposed a building of red brick, with a stone-faced front, and clock-tower, in the Gothic style. The hall would seat 440 persons on the floor and 66 in the gallery. Retiring-rooms were to be attached to the hall, at the platform end. The estimated cost was from 1,700*l.* to 1,800*l.* A provisional committee was appointed to make inquiries as to the number of shares which would be taken up, and whether the local Boards and other societies will agree to occupy the rooms, and on what terms. It was stated that the Philharmonic Society would take the hall, if erected, one night a week, at 25*l.* per annum.

Co-operative Hotels.—An adjourned conference of persons interested in the erection of co-operative hotels has been held at the Whittington Club, Arundel-street, Strand, Mr. J. S. Lowe in the chair. A report from a committee appointed at a previous meeting was brought up. The committee recommended that a limited liability company, to be called the Club Hotel Company, be formed, with a capital of 100,000*l.*, in shares of 10*l.* each. These resolutions were eventually approved, except that it was resolved that the company be called the Residential Hotel Company. Mr. Swindlehurst moved that a committee be appointed to draw up articles of association and a prospectus embodying the principles on which the company was formed. This resolution was adopted, and a committee was nominated.

The Money-order System Extended to the United States of America.—On the 2nd of October next, and thenceforward, money-orders may be obtained at any money-order office in the United Kingdom, payable at any place in the United States of America. The commission chargeable will be uniform with that charged on money-orders issued on Canada and the colonies generally, viz.:—1*s.* on sums not exceeding 2*l.*; 2*s.* on sums above 2*l.* and not exceeding 5*l.*; 3*s.* on sums above 5*l.* and not exceeding 7*l.*; 4*s.* on sums above 7*l.* and not exceeding 10*l.* No single money-order will be issued for more than 10*l.* The issue of money-orders in the United States, payable at money-order offices in this country, will also commence on the 2nd of October next.

The Columbia Market.—The Court of Common Council have unanimously agreed, in accordance with the desire of Lady Burdett Coutts, to take over Columbia Market, and maintain it as a general market for ten years, at the expiration of which time, should it prove a failure, measures are to be adopted to utilise it in a way that will most conduce to the attainment of her ladyship's object,—the material benefit of the poor people of Bethnal-green and neighbourhood. It was said that the market had cost nearly a quarter of a million of money. The estimated annual cost of managing and keeping it in repair is between 1,000*l.* and 1,500*l.* Our original fears as to its success have been sadly confirmed.

Improvements in Scarborough.—A prospectus has been issued from a company proposing to form nine acres of pleasure-grounds on the North Bay in Scarborough, contiguous to the new promenade pier, with a marine aquarium, refreshment-rooms, &c., in a large glass-covered hall; and to connect these grounds with the South Bay by a tramway laid on the level, through a well-lighted and ventilated tunnel under the cliff, which will enable visitors to pass in comfortable carriages from the attractions of the south to those of the north side, in about four minutes' time. The project is intended to be supplemental to the existing Spa Gardens.

Shipbuilding, Hull.—The prospectus has just been issued of a new shipbuilding and engineering company at Hull, for the acquisition of the old-established works of Messrs. C. & W. Earle. The firm has long been held in good repute, and the reason of the present transfer to a joint-stock company is the death of one partner and the serious illness of the only survivor. It is stated that the works have recently been removed to a new site on the bank of the Humber, with deep water sufficient to launch the largest iron-plated ships of war, and the works have abundance of land for present use and future extensions.

Contemplated Tunnel under the Clyde. Boring operations have been commenced at Clyde-street Ferry, in view of the contemplated construction of a tunnel at that point of the river. Three bores have already been put down, one on each side of the Clyde, and a third within the quay wall; but it is proposed to carry the experiments a little further. All the borings will be carried to the depth of 85 ft., and the results obtained up to the present time are satisfactory. Estimates are now being prepared with the view of ascertaining the cost of the undertaking, and the revenue likely to be derived therefrom. The construction of a tunnel under the Clyde is not a new idea.

Sir James Pennethorne.—In our notice of Sir James Pennethorne in our last (p. 717), we attributed to him the authorship of a book on the "Mathematical Principles of the Greek Architects." This is an error. The book referred to was the work of his brother, Mr. John Pennethorne, also an accomplished architect, and who has devoted his life to the investigation of the principles which governed the designs of the Greek architects, and on which he is now engaged in preparing for publication a very elaborate work.

New Public Hall at New Mills, Derbyshire.—This hall has been opened. It has been erected by public subscription, at an estimated cost of about 1,800*l.*, contains news-rooms, library, class-room, a room suitable for a savings-bank or committee-room, and a large hall suitable for public meetings, lectures, and entertainments.

Newcastle Improved Industrial Dwelling Company.—The ordinary general meeting of the shareholders of this company was held in the Merchants' Court, Guildhall, Mr. James Hall in the chair. The directors' first annual report said there were never fewer than fifteen or twenty applicants on the books for accommodation on the occurrence of any vacancy. The directors regretted that only 3,660*l.* of the capital of 5,000*l.* had as yet been subscribed. The company could pay 5 per cent. per annum on a capital of 5,000*l.*, and at the same time permit of a reserve fund being formed of 10 per cent. on the gross revenue to meet depreciation and repairs. The report was unanimously adopted.

Proposed Public Baths for Chatham.—A public meeting, convened by the high constable, in accordance with a numerously-signed requisition to that effect, has been held in the Lecture Hall, Chatham, for the purpose of taking the necessary steps for providing public swimming-baths for the town. At the commencement only some few persons were present, but the attendance was afterwards larger. It was resolved that public baths would be an important acquisition, and a committee was appointed to consider any plans for the erection of public baths and to seek an interview with the trustees of Watts's charity, and report thereon to a public meeting to be convened that day month.

Metropolitan School Requirements.—The London School Board is advertising for sites for schools in different parts of the metropolis. These schools are to accommodate 10,000 children, and are to be built by a loan of 100,000*l.*, obtained from the Loan Commissioners, with the sanction of the Education Department, on the security of the Education-rate. The districts for which this provision is to be made are the City and Tower Hamlets, Finsbury, Greenwich, Hackney, Lambeth, Marylebone, Southwark, Chelsea, and Westminster.

The Lancashire Statue of the late Lord Derby.—At a meeting of the Health and Recreation Committee of the Preston Town Council, on Monday, for the purpose of considering the form of the contemplated statue of the late Lord Derby in the Preston Miller Park, a number of plans and models were submitted, and after some discussion, it was suggested that the statue should not be covered by a canopy, as the one laid before them by Mr. Gilbert Scott. Eventually it was decided to place the statue below the promenade, and nearly opposite the fountain.

Improvements in Bath.—Our Bath readers will learn with satisfaction that there will be no more delay in the formation of the new street by the Midland Railway Company from James-street to Kingsmead-square. The demolition of the houses will be proceeded with on the 29th inst. The tender of Mr. Robinson, of Bristol has, it is stated, been accepted for the erection of new bonded stores by the Midland Company, near their station, the outlay being something like 5,000*l.*

Batley Waterworks.—The Mayor of Batley, on Tuesday, cut the first sod of the new Batley Waterworks, which are to be constructed at Yateholme, a little distance from the village of Holme, several miles beyond Holmfirth. The four reservoirs, when completed, will give a supply of two million gallons of water to the town of Batley per day; and had it not been for the rapid falls of the valley there, the supply would have been two millions and a half gallons per day. The whole cost of the undertaking will be about 200,000*l.*

The New School of Science at the Hartley Institution, Southampton.—Rapid progress is being made with the new buildings at the Institution. The main building now has the roof on, as well as the corridor. The School of Science is slated in, and the Archimedian screw revolving ventilators are fixed. The museum roof is also on, but not yet slated. The greater portion of it will be glass. The contractor is Mr. Crook, of St. Mary's-road, and Mr. Lemon, the borough surveyor, is the architect.

New Hospital at Lanark.—The foundation-stone of a public hospital for the district of Lanark was laid on the 14th inst. by Mr. Robert Monteith Carstairs. The institution, for which plans have been prepared by Mr. James Watson, architect, Dundee, is to be under the charge of the Sisters of Mercy.

New Free Church, Sighthill, Glasgow. The foundation-stone of this church, erecting by the members of the Free Tron Church, Glasgow, and other friends, has been laid. The church is in the Decorated English style, will contain about 1,000 sittings, and will cost 3,000*l.* A tower and spire, reaching to the height of 125 ft. are to be erected; and it is contemplated to put up a bell and public clock in the tower for the benefit of the locality.

Chichester Cathedral.—The restoration is going on of the Lady Chapel, in memory of Bishop Gilbert, having been built by an earlier prelate of the same name, Gilbert de Sco. Leofardo. The ante-chapel has been again thrown into the building, and reveals a lateral window (now closed up) like those of Chester and Hereford. The sedilia, laver, and aumbries are restored, and the stonework is renewed in the windows.

American Asphalte.—According to an article in the *Scientific American* there is enough asphalte in America for the wants of the whole of that country. The material has lately been introduced for paving purposes at New York, under the name of Grahamite, and is also being introduced for the Central Park. The paper named says, "It is here that its beauty is shown most perspicuously, and where its history as a successful pavement may be said to have fairly begun."

The Alhambra Nationale of Brussels, after the style of the Alhambra, Leicester-square, is now completed, and will be opened next week. The lighting is by Messrs. Defries & Sons, of London, and consists of a large central chandelier and sunlight of 500 jets, the under shade of which is of embossed glass, with a golden corona nearly 20 ft. in diameter, designed and manufactured expressly for this occasion.

The Stone Age in Egypt and Palestine. At the last meeting of the French Academy of Sciences, a paper was read by the Abbé Richard, on certain stone implements found by him in Egypt, on Mount Sinai, and in the tomb of Joshua. The sepulchre was discovered in 1863, by M. Guéria, and its authenticity was subsequently confirmed by M. de Saulcy.

Statue of the Prince Consort, for the Viaduct.—At the last meeting of the Court of Common Council, it was resolved that a sum not exceeding 2,000*l.* be expended in obtaining a pedestal on which to place the equestrian statue of the late Prince Consort, presented to the court for erection at Holborn Viaduct Circus.

The Foreign Cattle Market, Deptford.—At the last meeting of the Court of Common Council, it was stated that a new contract had been entered into for the erection of the whole of the works connected with the new foreign cattle market at Deptford, and that they were expected to be completed by December 15th.

Vacant Sites in the City.—The advertisement for a gentleman to arrange for letting vacant sites, &c., has brought a large number of applications. Two or three correspondents ask us to mention that they are candidates, but it would be without advantage.

Goods made by the Blind.—We desire to point attention to the circumstance that the International Exhibition at South Kensington includes a Department for Goods made by the Blind, and that a considerable number of articles will be found in it.

Breaking and Cubing Stone.—An improved machine for this purpose has been invented by Mr. J. R. Rider, of Melbourne, Australia, in which an oscillatory or vibratory motion is imparted to the upper part of a vertical lever or hammer.

The Commissioners of Sewers, London, have agreed to increase the salary of Mr. Swale, the sanitary superintendent, from 300*l.* to 400*l.* per annum, with an additional 50*l.* in lieu of house accommodation.

TENDERS

For villa on Plot 16, Crystal Palace Park Estate. Mr. John Norton, architect:—

Upson & Davey	£3,255	0	0
Wild	2,937	0	0
Pink	2,790	0	0
Baxter	2,780	0	0
Moore & Grainger	2,425	0	0
Watson	2,400	0	0
Peskett & Taylor	2,370	0	0
Hughesdon	2,200	0	0
Aitchison & Walker	2,105	0	0

For the erection of mortuary chapels, entrance lodge and gates, and dead-house, to the cemetery, Walthamstow, Essex. Mr. R. Charles Sutton, architect. Quantities not supplied:—

Kipps	£2,690	0	0
Reed	2,675	0	0

For new distillery, Hill-street, Finsbury. For Messrs. W. R. Sutton & Co. Mr. Bentley, architect. Quantities by Mr. Catherwood:—

Brown & Sons	£6,503	0	0
Manley & Rogers	6,437	0	0
Macey	6,390	0	0
Hookham	6,323	0	0
Kelly Brothers	6,127	0	0

For St. Mary's Schools, Cheshunt. Mr. A. R. Barker, architect. Quantities supplied by Mr. F. W. Hunt:—

Walton	£1,648	0	0
Pocock	1,527	0	0
Sanders	1,413	0	0
Messrs. Patman	1,4?4	0	0
Bentley	1,345	10	0
Archer	1,033	10	0

For the erection of a cooperage in King-street, Clerkenwell. Mr. W. P. Griffith, architect:—

Mitchell	£638	10	0!
Colwell	394	0	0
Lidstone	3?8	0	0
Bamford	340	0	0
Marten	326	10	0
Brooks (accepted)	287	0	0!

For works of sewerage for the Hornsey Local Board. Mr. Baldwin Latham, C.E., engineer. Quantities supplied by Messrs. Hovenden & Heath:—

Pearson	£33,087	0	0
Keeble	32,329	0	0
Neane & Son	30,517	0	0
Bloomfield	29,784	0	0
Hayward	29,606	0	0
Marshall	29,000	0	0
Brown	27,463	0	0
Vickers & Crane	27,211	0	0
Furness	25,300	0	0
Wainwright*	25,200	0	0
Anderson & Dunmore*	24,521	0	0

* Accepted.

For enlarging the present dining-hall, and for new baths, lavatories, w.cs., and urinals, and for erecting and finishing the new north wing and infirmary buildings at the Westminster Union Schools, Wandsworth-common. Mr. E. R. Blatchley, architect:—

Markwick & Thurgood	£4,360	0	0
Keeble	4,019	0	0
Gammon	4,048	0	0
Jackson & Shaw	3,987	0	0
Thompson	3,866	0	0
Higgs	3,863	0	0
Brass	3,809	0	0
Hill, Keddell, & Waldram*	3,796	0	0
McLachlan	3,739	0	0
Henshaw & Co.	3,609	0	0
Wiles	3,407	0	0

* Accepted. The preference here of a tender not the lowest was influenced, we are informed, by the circumstance of that firm being now engaged on a much larger work at the Home house in Poland-street, and which was said to be progressing satisfactorily.

For erecting stabling at Brixton-hill, for the London Tramways Company. Mr. James Edmeston, architect. Quantities supplied by Mr. Thomas Archer:—

Forrest	£1,829	0	0
Cowland	1,750	0	0
Longmire & Burge	1,685	0	0
Coleman, Brothers	1,650	0	0
High	1,645	0	0
Abraham	1,635	0	0
Taylor	1,607	0	0
Sharpington & Cole	1,597	0	0

For building a car shed at Brixton, for London Tramway Company. Mr. James Edmeston, architect:—

Watts	£1,511	0	0
Kilby	1,500	0	0
Roberts	1,430	0	0
Hives	1,360	0	0
Cowland	1,270	0	0
Longmire & Burge	1,229	0	0
Abrahams	1,182	0	0
Sharpington & Cole	1,177	0	0

For laundry and fittings at St. Luke's Workhouse. Mr. H. Saxon Snell, architect:—

Crockett	£1,800	0	0
Till	1,800	0	0
Turner	1,777	0	0
Thompson	1,774	0	0
Manley & Rogers	1,757	0	0
Brown & Sons	1,755	0	0
Saul	1,710	0	0
Crocker	1,659	0	0
Bamford	1,650	0	0
Wigmore	1,635	0	0
Howard	1,630	0	0
Bridgman & Nuthall	1,591	0	0
Perry Brothers (accepted)	1,589	0	0
Wall	1,559	10	0

For machinery, boilers, and pipes, for laundry at St. Luke's Workhouse. Mr. H. Saxon Snell, architect:—

Jeakes & Co.	£1,028	3	3
Elliott	990	0	0
Benham	810	0	0
Potter & Son	740	0	0
May (accepted)	690	0	0

For the erection of chapels, lodge, and entrance gates at Charlton Cemetery, Dover. Mr. J. H. Brown and Mr. J. B. Pearce, joint architects. Quantities supplied:—

Mackenzy	£2,232	10	0
Kelly	2,226	0	0
Bourne	2,145	0	0
Richardson	2,055	0	0
Adcock & Rees (accepted)	1,934	0	0

For the erection of seven shops, &c., King-street, Hammersmith. Mr. Edmund Woodthorpe, architect. Quantities supplied by Messrs. Welch & Atkinson.

Two shops for Mr. Killick:—

Turner & Sons	£2,301	0	0
Browne & Robinson	2,220	0	0
Ashby & Sons	2,200	0	0
Conder	2,200	0	0
Macey	2,198	0	0
Colls & Sons	2,167	0	0
Perry, Brothers (too late)	2,048	0	0
Adamson & Sons	1,979	0	0
Bird, Brothers	1,959	0	0
Chamberlen, Brothers	1,870	0	0

One shop for Mr. Jackson:—

Turner & Sons	£1,078	0	0
Ashby & Sons	1,040	0	0
Conder	1,030	0	0
Macey	1,030	0	0
Browne & Robinson	1,020	0	0
Colls & Sons	993	0	0
Perry, Brothers (too late)	981	0	0
Bird, Brothers	939	0	0
Adamson & Sons	927	0	0
Chamberlen, Brothers	899	0	0

Two shops for Mr. G. F. Horwood:—

Turner & Sons	£2,181	0	0
Browne & Robinson	2,100	0	0
Conder	2,100	0	0
Macey	2,097	0	0
Ashby & Sons	2,090	0	0
Colls & Sons	2,045	0	0
Perry, Brothers (too late)	1,931	0	0
Adamson & Sons	1,897	0	0
Bird	1,859	0	0
Chamberlen, Brothers	1,779	0	0

Two shops for Mr. George Meacock:—

Macey (error in cast)	£2,638	0	0
Turner & Sons	2,329	0	0
Conder	2,250	0	0
Browne & Robinson	2,240	0	0
Ashby & Sons	2,230	0	0
Colls & Sons	2,190	0	0
Perry, Brothers (too late)	2,058	0	0
Bird	2,029	0	0
Adamson & Sons	2,025	0	0
Chamberlen, Brothers	1,917	0	0

For the erection of a church for Scandinavian Seamen, Commercial Docks, Rotherhithe. Mr. Edward Biven, architect. Quantities supplied by Messrs. Franklin & Andrews:—

Wood	£2,600	0	0
Higgs	2,274	0	0
Nixon & Son	2,247	0	0
Macey	2,175	0	0
Dove Brothers	2,175	0	0
Nutt & Co.	2,148	0	0
Jackson & Shaw	2,050	0	0
Henshaw & Co.	2,015	0	0
Nightingale	1,999	0	0
Ennor	1,979	0	0
Mann	1,967	0	0
Hibbins & Trasler (accepted)	1,892	0	0

For six cottages at Pirton, near Hitchin. Messrs. Habershon, Pite, & Fawkner, architects:—

Ealing	£985	0	0
Gourling	869	0	0
Daniels	769	0	0
Field	761	0	0
Pearce	735	0	0
Rooney Brothers	735	0	0
Warr	694	0	0
Bint & Co.	638	0	0

TO CORRESPONDENTS.

J. B.—W. T.—J. N.—T. J. H.—S. K.—B. C.—H. A.—R. R—J. E.—P. B.—B. W. J.—J. V.—F. T.—T. P.—W. D.—F. C.—J. C. A.—A. B. W. H.—A. D.—J. D. & Son.—P. P.—F. C.—B. & P.—J. R.—E. B.—S. & C.—W. W. L.—J. S. M.—Messrs. G.—Dr. B.—H. S. S.—Flying Scud (zinc is a simple metal, not compound).—Aqua (good Portland cement properly used).—J. T. L (publisher's name is given; every bookseller knows it).—G. S. A. (thanks).—"Shepton Mallett" next week.

We are compelled to decline pointing out books and giving addresses.

All statements of facts, lists of Tenders, &c., must be accompanied by the name and address of the sender, not necessarily for publication.

NOTE.—The responsibility of signed articles, and papers read at public meetings, rests of course with the authors.

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